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PRACTICAL DIVISIBILITY OF THE ELECTRIC LIGHT.

Electric lighting has advanced in the last three or four years from a mere experimental stage toward the practical and useful solution of the great problem.

The desirability of the electric light has been generally admitted, and its sanitary advantages have been conceded even by its opponents, while its entire freedom from danger of every kind is not the least of its advantages. According to the opinion of several eminent experts, it can be produced on a large scale at prices which compare favorably with those of gas at its cheapest.

The daily increasing use of the electric light is an evidence in its favor. So far, however, it has been applied to the illumination of large areas, and it has been generally believed that its application to household purposes, or to other uses where it must be subdivided, is exceedingly difficult, if not altogether impossible. There are certain practical difficulties in dividing the electrical current, so as to produce a number of small lights by means of a single generator, which have baffled the ingenuity of inventors so far, and which must effectually block the progress of subdivision in this direction, unless some new principle is discovered. It is stated that no matter how cheap the original current may be produced, the loss by division is so great that small lights must be expensive.

In the system illustrated in our engraving, Messrs. Molera & Cebrian, civil engineers, of San Francisco, Cal., have attempted the direct division of the light. They employ optical contrivances, leaving the current undisturbed and undivided, doing away with expensive electrical conductors, and dispensing with lamps or regulators at points where the lighting is to be utilized.

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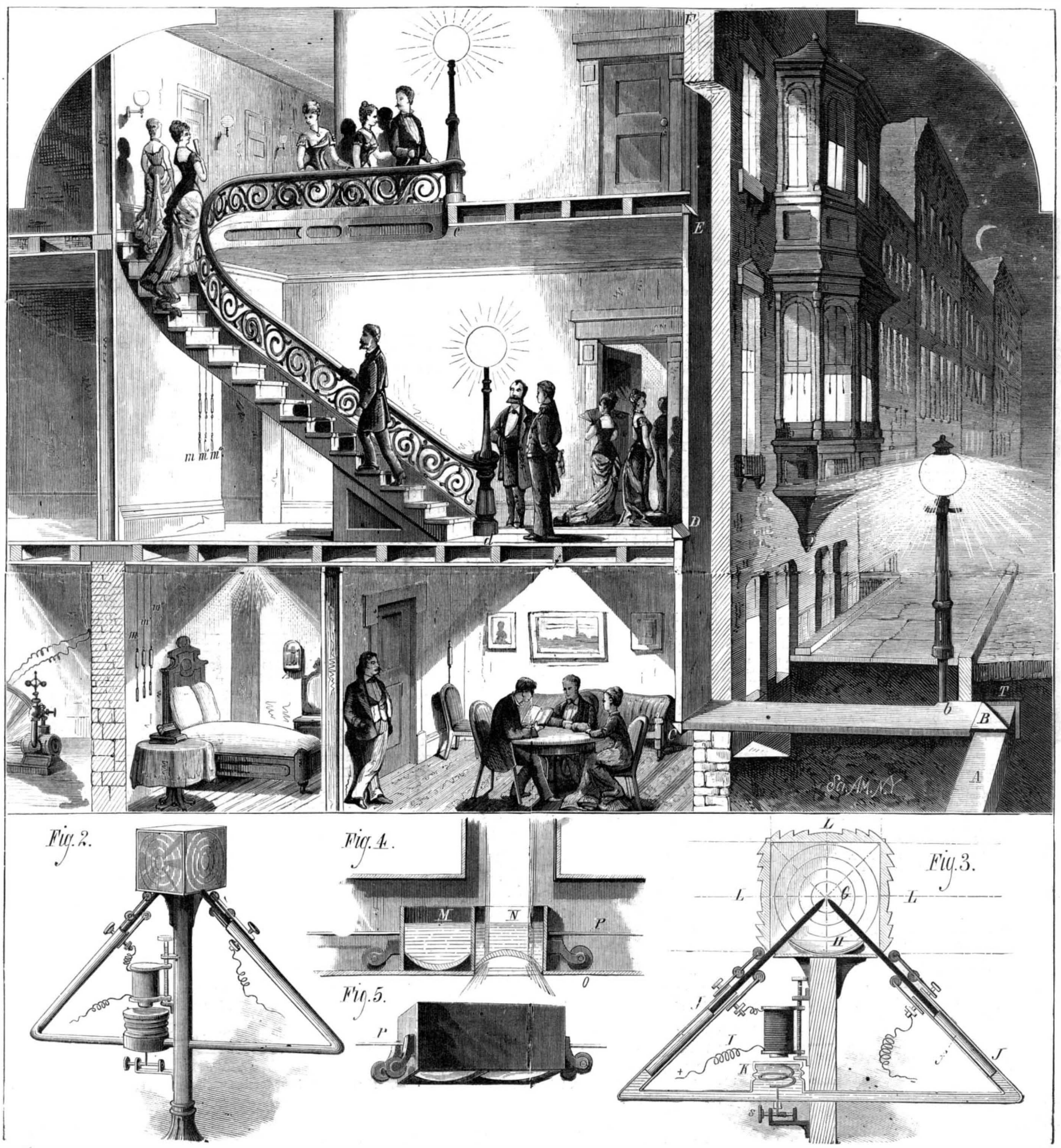

MOLERA & CEBRIAN'S SYSTEM OF ELECTRIC LIGHTING.

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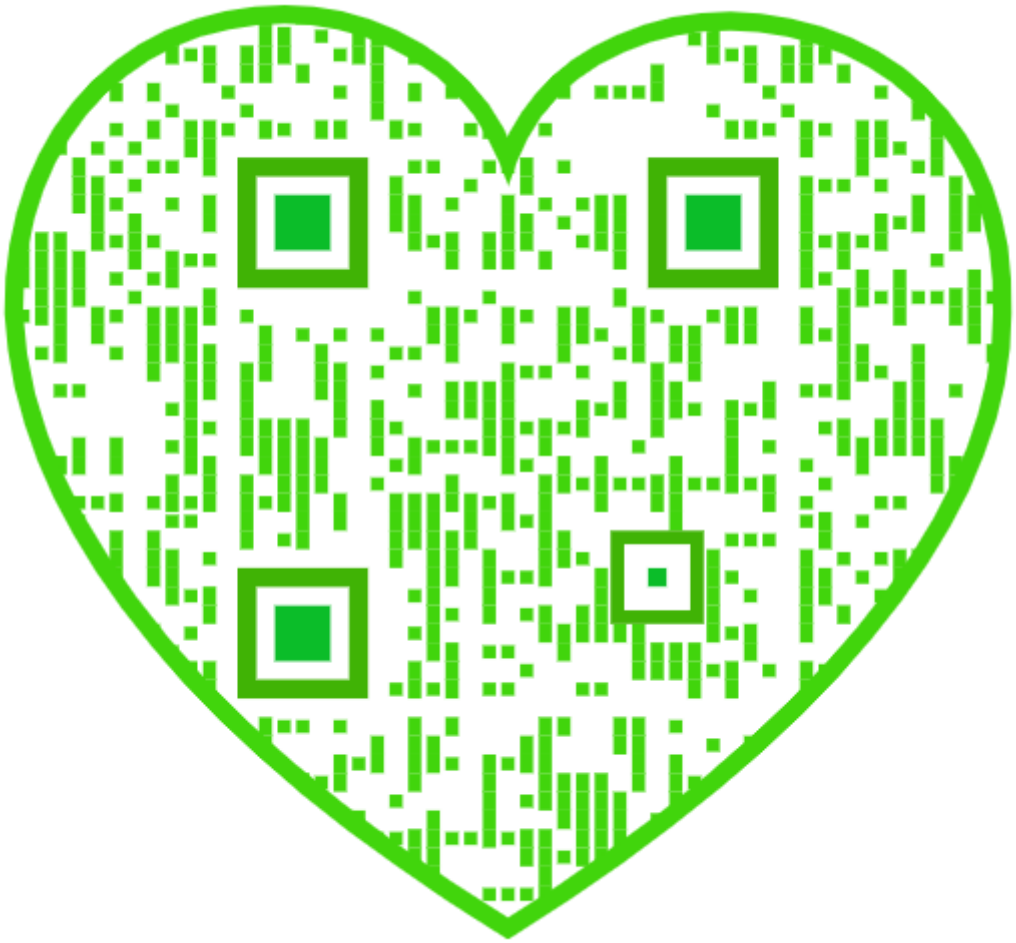

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NEW YORK, SATURDAY, JUNE 21, 1879.

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On the Form of the Stern and the Arrangement of the Propellers in Screw Ships in Order to Obtain the Best Effect in Propulsion. By ROBERT GRIFFITHS, C.E. A very important paper read before the United Service Institution, April 21.
Useful Notes for Masters and Officers of Screw Steamers.
Spiral Slide Rule. A portable calculating instrument invented by Professor George Fuller. 1 illustration.
Tire Grinding Lathe. Designed for the Austrian State Railways. 3 engravings.

II. MINING AND METALLURGY.—Iron and Steel. Inaugural address of President Edward Williams, of the British Iron and Steel Institute. Initial processes. The Bessemer discovery. Puddling. Improved working. Steel and its uses. Remelting. The new steel making process. Steel making economies. The future of iron. Iron making furnaces. Foreign and American competition. Wasteful ingot making. Rolling machinery. Scientific training needed. Unqualified managers. Future prospects.
The Removal of Phosphorous and Sulphur During the Bessemer and Siemens-Martin Processes of Manufacture. Paper read by GEO. J. S. SNELUS before the Iron and Steel Institute, with discussion.
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III. TECHNOLOGY.—Ornamenting Textile Fabrics. By WILLIAM W. CARPENTER.
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Rational Utilization of the Water for Fulling Mills. By A. GAWOLOVSKI.—Compressed Flour.

IV. RECENT SCIENCE.—Continuation of Paper in SUPPLEMENT No. 17. New products from beets. Chemistry of yeast. Chlorophyl containing animals. Nuclei of cells. Maturation and impregnation of the animal ovum.

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A PRAIRIE BOY'S EXPERIENCE.

The habit of intelligent industry is, all things considered, not only the best legacy a father can leave his sons, but one of the most enduringly valuable elements of any boy's education. Emphasis, however, is to be laid on the word "intelligent." Habitual hard work, with no other motive than compulsion, is sheer slavery; and many a parent has found his efforts to make his sons industrious thwarted and their lives spoiled, simply because he has unwisely undertaken to give them the training of slaves, not that of free spirited and interested toilers. It is not the amount of work that boys do, but the manner of their doing it that makes them like or dislike hard work.

Absolute idleness in youth is often a better preparation for successful effort in riper years, on the farm or in the workshop, than a youth of unwilling drudgery. And one cause of the eagerness of country boys to abandon farm life has been—and this the chief cause—the unwisdom of parents in making their boys feel to the full the monotony and drudgery of farm life while restricting in every way its enjoyments. When boys are given a liberal foretaste of the freedom, the wholesome joys, and the profits of country living, they will be less likely to feel that anything is better than farming. And the same laws hold in every other industrial calling.

We are led to dwell upon this aspect of parental management by a Kansas letter to the New York *Tribune*, in which the writer tells the story of a prairie boy's experience at the hands of a wise father. The setting of the story we have no space for. Suffice it to say that it came out of a casual encounter between a country boy and the writer, who had lost his way. While conducting the traveler to the road he had strayed from the young pioneer contrasted his father's plan of encouraging his boys in being industrious and that of a neighbor.

"Now, there is Mr. A., who lives on the quarter section adjoining ours, and he has two sons, John and Henry. John is a little older than I, and Henry a year younger. Well, the way he encourages his boys is by having them up by daylight in the morning and keeping them on a keen jump all day long. He hardly allows them time to eat their meals. Why, last summer they worked till 9 o'clock every evening, and didn't find an hour all summer in which they could go a fishing, or even in swimming. Then to pay them the old man gives them their board and his own worn out clothes, with occasionally a pair of boots or something of the kind thrown in. That is the way he teaches them to be industrious. But father's plan is entirely different. He gave me four acres of land which he had broken (this was two years ago last spring), and I was to do just what I pleased with it, and he would furnish me seed or means to obtain seed; all that he required of me was that I should attend to the garden, do the chores at the barn, and go to school in the winter.

"The first year I planted corn, and from my four acres I raised 120 bushels, which I sold for 30 cents a bushel.

"The next spring father let me have the use of his team, and I plowed my four acres and planted one and a half acres in castor beans, one half acre I put out in strawberry plants, one acre in sorghum, two rods in onions, and the remainder of the acre in sunflowers. Father laughed when I told him my plans, but he said it was my own land and I could do as I liked with it. I told him I wanted to experiment on different crops, so as to see which was the most profitable. Well, my castor beans were a good deal of trouble. I had to watch them so closely not to lose them when they cracked open. It was necessary to pick them immediately as fast as they ripened; but my little sister, seven years old, could attend to them about as well as I, and she did this faithfully on my promising her $5 when I sold my crops in the fall. I raised twenty-two bushels of beans off of my one and a half acres, which I sold at $1.25 a bushel, so after paying my sister $5, I realized for them $22.50. Father had raised considerable sorghum, and he had all of the arrangements for pressing, boiling, etc. We worked together in preparing our sorghum, and I had from my one acre two barrels of good sorghum molasses, which I sold for 35 cents a gallon, thus making $22 from my sorghum crop. My sunflowers, which were the laughing-stock of so many, brought me enough to pay me for my trouble. I had planted and cultivated them very much as if they were corn. The flowers were splendid, many of them measuring three feet six inches in circumference, the stalks being from ten to twelve feet long and three inches in diameter. I planted them principally for the stalks, which I sold over at the next town for fuel. I had ten cords off of that part of an acre, and I realized $15 from the sale of them. I gave the seeds to father for his poultry. He thinks they are better than corn. Those who bought the stalks say that they burn readily, and make a very hot fire.

"Last spring I planted nothing but sorghum and onions, as they had brought me the most the year previous, and I have done better than either year before. My onions were the most profitable crop of all, as I made $12 off of my two rods. So last fall I had, after disposing of my crops, $71.50 in cash, nearly double what I had made the year before. I spent $20 of this on my wardrobe, $10 at Christmas, bought three more calves at $10 a head, and had $11.50 left for sundries. My onions didn't do quite as well as the year before. So this year I have made $300 off of my four acres. I can assure you I am beginning to feel very much encouraged in being industrious. I have just bought twenty more calves. I had to pay $12 a head for these, but they are beauties, I can tell you. If they do well they ought certainly to be worth in a year from now $450. I was offered $90 to-day for my other lot. I have no trouble in finding a market for my produce; for what I cannot sell here I ship on the railroad, and, as they carry at reasonable rates, I often prefer shipping, as I get better prices in the larger towns. I shipped nearly all of my strawberries this year.

"I was fifteen years old last August, and am worth to-day $390. To be sure my father has favored me in every way, furnishing me with seed, feed for my stock, allowing me the use of his team and farming implements, etc. But now I can afford to be more independent, and hope before long to help him, instead of his helping me. Father is making money, too. This is a fine wheat country, and he has put the most of his land into wheat. We have had fine seasons so far for our crops, and next year we may have grasshoppers or drought, or some drawback; but we have enough ahead now to stand one or two unprofitable seasons, so we don't worry. I intend to invest every year in stock, as I have found it far more profitable than anything else."

The moral of the story goes without telling.

UNKNOWN NEW YORK.

That the State survey of the Adirondack wilderness should have discovered mountains, lakes, and other geographical features as little known to the world as the mountains and lakes of Central Africa, was not surprising. It does strike one as strange, however, that the geography of the central counties of the State should be little if any better understood. Yet the State surveyors found last year that every one of the cities and towns of that region, to the number of two hundred or more, were from one to two miles out of place, on every map of the State hitherto published. And worse than that, the topographical features of that thickly settled and prosperous part of the State are sadly misrepresented on all our maps. In reviewing the work of the survey during the past year, Director Gardner remarks that "few people realize that in the central part of our State, represented on their maps as level regions, are mountains rising to such heights above the surrounding country that the eye can sweep at a glance 5,000 square miles of land and lakes, touching here and there blue horizons over sixty miles away." The deep pleasure which these broad but unvisited views inspired very naturally increased Mr. Gardner's regret that the topography should be so unknown to educated people. "In Germany," he says, "every child is taught the physical features of its native country; but in New York, neither young nor old know the aspects of those counties which they have not personally visited. In this matter, like the Indians, they know only what they have seen." This criticism he makes on the strength of a wide intercourse with the intelligent citizens of central New York, to whom he has often put questions to test their knowledge of the topography of their part of the State.

"I am led to recur to this subject," he concludes, "because of the deep impression made upon me each season by the unexpected grandeur, beauty, and variety of the landscapes seen in the prosecution of our work. Ideas of the aspects of the State derived from maps have, in my own case, proved to be so false and vague, that I find in this survey the attractive novelty of exploring an unknown region. Colorado was not a greater surprise to me than has been the structure of my native State. In the study of the origin of some of its most remarkable features lie untrodden tracts of knowledge which are yet to awaken great interest. The configuration of a part of central New York is as unique and as unknown to science as that of any part of the Rocky Mountains."

STRIKE OF PITTSBURG PUDDLERS.

By the strike of the puddlers of Pittsburg, Pa., June 2, something like 40,000 men were thrown out of employment in that city and in Allegheny, with the prospect of stopping the work of all the men employed in the coal mines and other establishments connected with the mills. A few mills which were practically independent of puddlers, remained at work, but with small prospect of continuing long. The *Herald* report of that date says:

"This morning, about ten o'clock, 200 puddlers formed into a line and marched up Liberty street and Pennsylvania avenue to the steel works of Hussey, Howe & Co. They threatened the employes of this firm with unpleasant results if they did not stop work. The firm has only sixteen puddlers, although it employs 500 hands. The men would not stop work in the middle of the day, but said they would to night. The strikers then separated and went to various mills where they thought there were any 'black sheep,' or men who were disposed to work at less than regular rates, and they ordered all such men not to go to work. This is the first strike in which the iron workers have stopped the steel workers."

As usual this is not a strike of labor against capital, but rather the action of a few unscrupulous workmen who are willing to take advantage of their position to stop the wages of ten times their number of fellow workmen.

THE UTILITY OF BEES.

One of our foreign exchanges states that a great bee master, the Rev. M. Sauppe, in Lückendorf, has made the following calculation, intended to prove the eminent agricultural and economical importance of the rearing of bees:

Of each of the 17,000 hives to be met with in Saxony 10,000 bees fly out per diem—equal to 170 millions—each bee four times, equal to 680 millions, or, in 100 days, equal to

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680,000 millions. Each bee, before flying homeward, visits 50 flowers, therefore the whole assemblage has visited 3,400,000 millions of flowers. If out of the ten only one flower has become fertilized, 340,000 millions of fertilized would be the result.

Supposing the reward for the fertilization of 5,000 flowers to be one German pfennig, the united bees of Saxony have obtained per annum a sum of 68 million pfennigs = 680,000 marks ($170,000). Each hive represents in this way a value flowers of ten dollars.

PHILANDER HIGLEY ROOTS.

Another of the pioneers in American invention and mechanical industry, Mr. P. H. Roots, of Connersville, Ind. has come to the end of a long and useful life. Mr. Roots was born in Rutland, Vermont, Nov. 17, 1813. In his fifth year his parents removed to Oxford, Ohio. His mechanical genius developed early. While still in college he experimented with rotary engines, achieving notable results for the facilities for construction at his command. About the same time he developed a plan for raising water by means of the condensation of steam, the apparatus, though imperfectly made, proving quite a success.

After completing his college course, at Miami University, Mr. Roots went into business of woolen manufacturing, with his father and two elder brothers. The crude and imperfect machinery in use at that time was very unsatisfactory to him, and much of his time was spent in constructing appliances of various kinds to save labor and do more perfectly the work that at that time was done almost entirely by hand. Many of these devices were entirely successful, and were in constant use until the woolen mill of which he was part owner was burned in 1875. Probably all of them were patentable. He early made a model for a power loom, having a positive motion for throwing the shuttle derived from the motion of the lathe itself. Several years after he invented a cam motion of a peculiar kind for working the harness of power looms. The arrangement was such that it could be easily changed to weave any regular fabric, with any number of leaves, each of which had a positive motion, and was entirely independent of the others. The plan was afterwards patented by other parties, and is in successful use in nearly all the mills in the country. He also invented a Jacquard arrangement for fancy cassimere looms, which was successfully used for many years, and probably was inferior only to the Crompton loom in point of workmanship.

He also constructed a warping mill for woolen goods, in many respects superior in its general adaptation to all kinds of work, warping, sizing, and drying perfectly in one operation. Many other devices might be mentioned, for they were, his brother says, all through the mill, and no machine was accepted as being perfect, even from the best manufactories, unless it could do all he thought it ought to do in the best manner.

Between 1856 and 1860, in connection with his brother F. M. Roots, he developed and perfected the rotary blower, so widely known throughout the mechanical world. Mr. Roots, however, was not an inventor only. His knowledge of every department of the woolen manufacture, in which he was so long engaged, was uncommonly extensive. He was also a great reader, and was widely respected for varied and extensive information. In his family and social relations Mr. Roots was greatly beloved and respected. He died Sunday, May 18, 1879.

Steam on Third Avenue.

A trial of the Angamar steam motor was made on the Third Avenue surface road, June 2. During the day several trips were made from Sixty-fifth street to Printing-house Square, in connection with one of the large open cars. The conductor said the motor could have drawn two or three cars if necessary. As it passed up and down during the busy hours of the day it attracted a great deal of attention, and caused no little fright to some spirited horses. On several occasions ladies wishing to take a car of the Third Avenue line declined, with a dubious shake of the head, the conductor's invitation to get on board. Others however, showed no hesitation. The engineer managed the starting and stopping on signals from the conductors of the motor and the attached car with apparent ease and promptness. The motor resembles an ordinary street car in shape, but it is higher and larger. The driving machinery is under the floor. On the front platform are the small furnace and boiler. Here also the engineer sits with his hand on the lever. Hot water is pumped into the boiler at the depot, and little fire is needed to keep it at the steam generating point.

The president of the railroad company said that the company had determined to adopt some substitute for horses as soon as a satisfactory one could be found.

Centrifugal Force and Fly Wheels.

It is not always that practical men are willing to admit the value and importance of scientific knowledge as regulating the operations and accidents of a workshop. We had a valuable incident of the kind that forced itself upon our notice, says a foreign contemporary, a few days back. A large pulley or rigger, 3 feet in diameter, and very wide, was split across its rim by carelessness in unloading; at the same time it was noticed that two of the arms out of six were cracked by contraction in cooling. In order, however, to save expense it was proposed to patch the broken rim of the pulley with wrought iron plates, which was done. "Per se" the iron plates were stronger than the original casting, but the whole weight of the patch amounted to about 15 lbs. As the pulley revolved at the rate of six hundred revolutions a minute, this unbalanced weight on the rim became by calculation as much as 7½ cwt. radial force outwards. This scientific result was brought to the knowledge of the practical men, but they could not see why the pulley would not do very well if the patch was as strong as the rest of the rim. The pulley was accordingly run under protest, and hardly had the maximum speed been attained before the pulley flew in pieces, and might have been dangerous to life and limb. The pulley, undoubtedly, broke, as above indicated, by centrifugal force, which, by the unbalanced patch of 15 lbs., caused a breaking radial pressure outward upon the broken rim at the position of the patch of 7½ cwt. This was quite sufficient to break the rim outward with enormous force, so that the pieces flew about the shop like fragments of a bursting shell. It will be well for machinists to remember this incident when they have occasion to repair fly-wheels.

Natural Enemies of the Electric Telegraph.

There is, apparently, no apparatus so liable to be interfered with by what we may call natural causes as the electric telegraph. Last week we saw what perils from vermin and fungus environ the subterranean wires. Fish gnaw and mollusks overweight and break the submarine conductors; while there is at least one instance of a frolicsome whale entangling himself in a deep sea cable, to its utter disorganization. It is stated that within the three years ending 1878, there have been sixty serious interruptions to telegraphic communication, in Sumatra, by elephants. In one instance, these sagacious animals, most likely fearing snares, destroyed a considerable portion of the line, hiding away the wires and insulators in a cane brake. Monkeys of all tribes and sizes, too, in that favored island, use the poles and wires as gymnasia, occasionally breaking them and carrying off the insulators; while the numerous tigers, bears, and buffaloes on the track render the watching and repair of the line a duty of great danger. In Australia, where there are no wild animals to injure the wires, which are carried great distances overland, they are said to be frequently cut down by the scarcely less wild aborigines, who manufacture from them rings, armlets, and other varieties of barbaric ornament. It has been suggested as a means of protection in this case, that the posts should be constructed of iron, when the battery could be used to astonish any native climbing them with felonious intent.

Governor's Island for the World's Fair.

The latest site proposed for the World's Fair of 1883 is Governor's Island. The island lies in New York Harbor, about half a mile south of the southern extremity of the city, and is about a mile in circumference. The proposer says:

"Here would be 'room and verge enough,' and to spare; and in the requirements it surpasses in many particulars all other suggested sites. Access to the island could be had by steamboats by means of a pier which should extend several hundred feet from, say, the north shore. Specially constructed and arranged ferryboats could ply to the island, connecting with New York at its lower part, and higher up on the North and East Rivers, and also with Brooklyn, Jersey City, etc. The pier would also afford facilities for excursions to the Exhibition by steamers from the principal river and seacoast cities and towns of the New England, Middle, and Southern States. This direct water communication would largely contribute to the success of the Fair by affording quick and non-fatiguing, as well as cheap means of travel from and to distant sections of the country. In addition there might be a bridge of boats across Buttermilk Channel connecting the island with the shore of Brooklyn."

The great objection to this site would seem to be the circumstance that the island is a fortified post of the United States, and not likely to be surrendered for the purposes intended. Besides, it would furnish no proper site for the permanent buildings to be erected by the city and State.

A Fatally Polluted Stream.

A distressing case of wholesale poisoning, through criminal ignorance or worse, has just occurred in a country school, in Vermont. The school opened Monday, May 26, and as usual the children got their water from a little brook that ran close by. The teacher noticed the bad taste of the water and forbade its use; but the caution came too late or was neglected, and in a little while seventeen of the children were prostrated with alarming illness, ten or twelve dying within a day or two, the bodies of the dead corrupting so rapidly that immediate burial was necessary. Investigation showed that a farmer had polluted the stream by the carcasses of a horse and several sheep, and the drainage of his barnyard. A medical investigation resulted in a report that diphtheria was the cause of the terrible mortality, aggravated by poisoned water. Diphtheria in a mild form had been in the vicinity, and four cases were known to exist, so that water poisoned by barnyard drainage and putrid carcasses of dead animals was just the thing to feed the disease into the development of the terrible disaster. One would think that the putrid carcasses would sufficiently account for the fatal pollution of the water.

Prejevalsky's Expedition to Lhassa.

If no mishap has befallen the Russian explorer, Colonel Prejevalsky, he is now pushing across the great sandy desert traversing the western center of the Chinese Empire, somewhere in the neighborhood of Suchau. His intention is to proceed across the marshy Tsaidam district to the Thibetan plateau; then, after joining the usual caravan route from Koko Nor to Lhassa, he will proceed as far as the latter city, which is the great object of the present expedition, and if possible make an excursion into the unknown country to the southeast, where Thibet abuts on the extreme eastern Himalayas. He proposes to return partially by the same route, but eventually to deviate toward Khotan and Kashgar. The entire journey is estimated to last two years. The expedition is fully equipped with money, firearms, and ammunition, and meteorological and astronomical instruments.

Eight Minutes Under Water.

A boy seven years of age was seen to fall from a bulkhead into the Hudson River, June 2. After considerable delay a youth named Thomas Berry came to the rescue, and the spot where the boy sank was pointed out to him. By a plucky dive and a long swim under water he succeeded in recovering the boy, who had been in the water eight minutes, and was apparently lifeless. A successful effort was made to resuscitate him, signs of returning consciousness appearing at the end of twenty minutes. The officers of the patrol of the water front pronounced this the most remarkable case of resuscitation after long submergence that had come within their knowledge, and it was put upon record as such. The happy issue should encourage hope and persistent effort in all similar cases.

The Forster-Firmin Amalgamator Co.

In the SCIENTIFIC AMERICAN of November 2, 1878, the Forster-Firmin system of amalgamating the precious metals was described and illustrated. The first annual report of the officers of the company controlling the system indicates a promising future for it. Machines are now building for use in Arizona and Idaho, and arrangements are being completed for their introduction in Colorado and California. It will be remembered that by this process the mercury is atomized by steam, compressed air, or other equivalent medium, and forced through a stream of pulverized ore. By this means, in connection with their system of washing and settling, the inventors claim to obtain all the precious metal in the ore, and also to recover nearly if not quite all the mercury used; the economy of the process being such as to make the system profitable with poor ores.

THE ISTHMUS CANAL.

The International Canal Congress came to a decision May 28, adopting by a vote of twenty-nine to sixteen the Wyse Panama canal without locks. This, project, it will be remembered, contemplates a canal, substantially along the route of the Panama Railway, nearly 45 miles long, with a tunnel 3¾ miles in length. To this project the President of the Congress, M. de Lesseps, was committed from the start, and it was through the influence of its projector that the Congress was called. The local influence brought to bear in its favor was irresistible, the result showing a splendid victory of social over civil engineering. M. de Lesseps immediately began the formation of a company to carry out the project, announcing that a first subscription of 400,000,000 francs will be opened simultaneously all over the world about September next. It is to be an essentially popular loan, without government aid or guarantee. The amount of the first subscription, of which 10 per cent is to be paid on subscribing, will, M. de Lesseps expects, be more than covered. Mr. Nathan Appleton will be a director of the company, and will be delegated to open subscriptions in the United States.

It is also announced that M. de Lesseps intends to proceed to Panama, by way of New York, to take out the first spadeful of earth on the 1st of January, 1880. The intention is to have the canal open for commerce before the year 1900; a result we reckon to be contingent on clever financial engineering rather than on social or civil engineering, great as may be the problems thrown upon the resources of the last.

American Society of Civil Engineers.

The eleventh annual convention of the American Society of Civil Engineers will be held at Cleveland, Ohio, beginning Tuesday, June 17. From the list of topics to be considered and the names of those expected to contribute papers and take part in the discussion, it is safe to predict an enjoyable and profitable meeting. During the meeting the Society will visit Pittsburg to inspect the government works for the improvement of the river at that place.

James Orton Woodruff.

Those who were interested in the Woodruff Scientific Exphdition will be pained to hear that its projector died at his residence in this city, June 4, of brain disease, brought on by the care, anxiety, and overwork connected with his great enterprise, which was temporarily abandoned May 8. Mr. Woodruff had just developed a new plan, which had been accepted by Prof. Clarke and others interested, when inflammation at the base of the brain terminated his life

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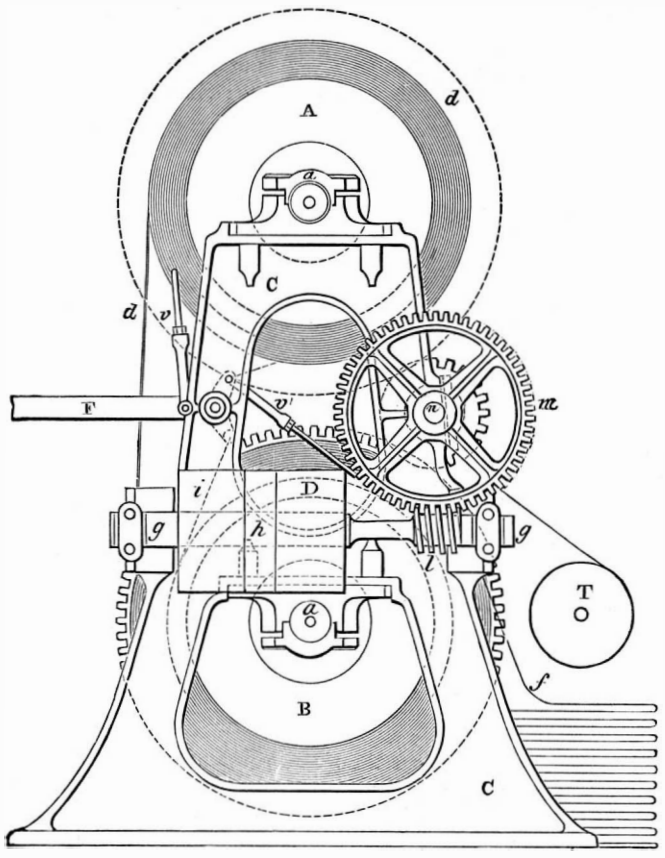
IMPROVED FINISHING PRESS.

The engraving represents an improved machine for finishing textile fabrics, invented by Mr. Houston. In machines of this kind the goods are generally passed between drums heated by steam, and are, besides being exposed to pressure and heat, subjected to a longitudinal strain in passing from one set of drums to the other. Besides that the heat to which the different portions are exposed is not equally divided, some parts being overheated and sometimes burnt, while others are not even completely dried. These disadvantages Mr. Houston claims to have overcome in his machine.

There are two large drums, A and B, through which steam circulates. P and R are toothed wheels firmly connected with the drums. They are acted upon by cam wheels, *o* and *p*, respectively, on the shaft, *n*. Both cam wheels may be withdrawn and replaced again in position by means of the sliding collars, M and N. H and I are friction pulleys. The shaft, *n*, is turned by an endless screw and toothed wheel, receiving their motion from a belt and pulley. The collars, M and N, and the cam wheels, *o* and *p*, turn the drums in opposite directions; one cam wheel only works at a time, the drum not acted upon by the cam wheel being carried along by the friction pulley. Thus the operator is enabled to change the motion of the drum as often as necessary. From the drum, A, to the drum, B, a long sheet or band of copper or steel extends, and alternately winds and unwinds round both drums, carrying the goods along. The fabric is unrolled from a cylinder, T, moved solely by the tension of the goods as they are rolled on the cylinder, B. The copper band is heated on the cylinder, A, and catches in descending the sheet of cotton, linen, etc., and rolls up along with the same on the cylinder, B. Thus the entire surface of the goods comes in contact with the heated metal, and is equally exposed to the pressure exerted by the concentric sheets of copper. The goods are in no way strained, but subjected to heat and pressure only, and all folds are effectually removed.

Very little attendance is necessary; one man can attend to several machines.—*Musée de l'Industrie.*

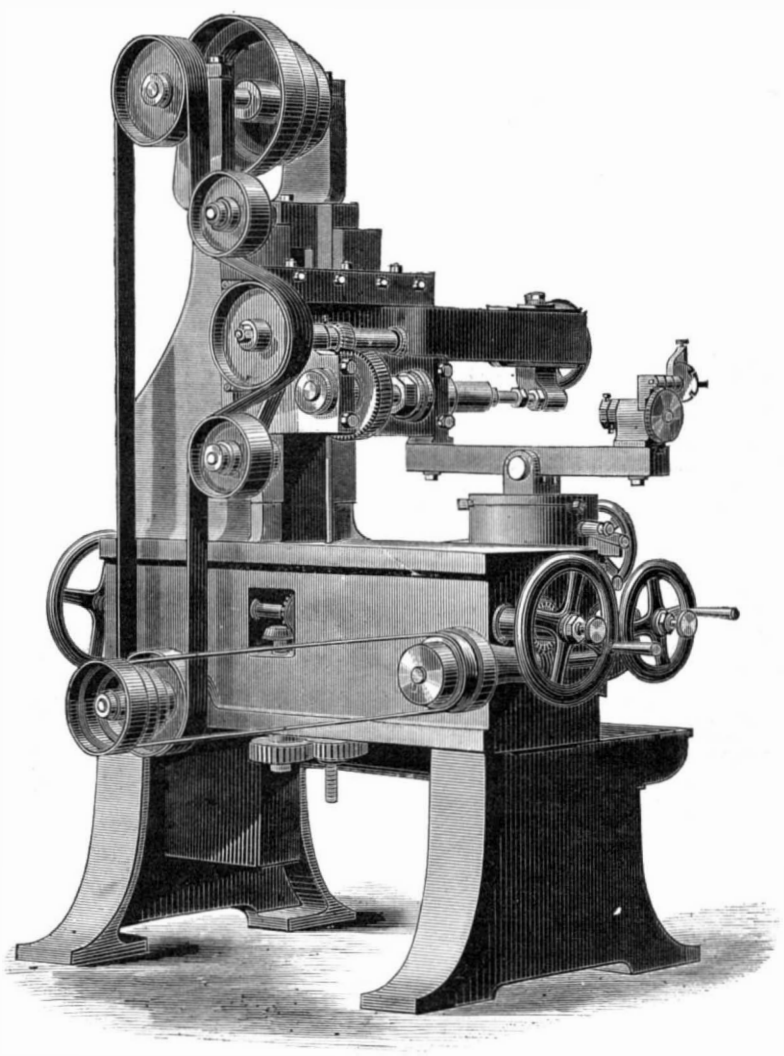


THE HOUSTON ROTARY FINISHING PRESS.

MILLING MACHINE.

We give a perspective view of a handy type of self-acting universal milling machine constructed by Messrs. Greenwood and Batley, of Leeds. As will be seen from our engraving, which we take from *Engineering*, the machine has a deep bed supported on two short standards, and having cast in one piece with it the upright which carries the milling headstock. This headstock has a vertical traverse of about 10 inches, and it is provided with a self-acting downward feed. On the milling spindle is a gun metal spur wheel, into which a wrought iron pinion gears, this pinion being on the same shaft as a belt pulley. The milling saddle also carries a pair of idle pulleys, and the driving belt passes round these and the pulley on the pinion shaft, in the manner shown by our illustration, the milling headstock being thus free to be moved up or down without interfering with the driving gear.

The milling saddle, which has a self-acting feed and stop motion, and the horizontal traverse of which is about two feet, moves on a slide formed on the side of the deep bed of the machine. On the saddle is mounted an accurate dividing motion, with thirteen rows of holes gearing up to 144 divisions. The dividing motion carries on its top a four jawed chuck taking in articles up to three inches in diameter, and also sufficing to hold a vise or other mountings. The machine is altogether a very handy one, suitable for a variety of work. We may add that one of these machines was exhibited by the makers at the Paris Exhibition last year.



UNIVERSAL MILLING MACHINE.

Morocco.

Philadelphia stands at the head of the morocco trade of the United States. The amount of this kind of leather made by the thirty-two firms engaged in the business is placed at $4,000,000 annually. During the busy season 1,080 dozen goat skins are daily turned into morocco; this would require at the rate of 4,000,000 skins a year.

The trade has gone through the financial crisis and recovered therefrom, notwithstanding the heavy losses. The sales for the season now over are ahead of those for the same period last year, and have been fairly satisfactory. The demand for brush kid has been heavier during the past season than was ever before known in the history of the morocco trade. The skins used are Tampico, Cape, Curaçao, and South American, known as soft stock, and Patnas, Madras, and Cawnpore Madras, classed as hard stock. These terms are applied to the condition of the skin in the hair and before tanned. Of late years the European skins have been largely worked into cheaper moroccos. Brush and glazed kids, bright and dull pebbles, maroons, and straight grains, both black and in fancy colors, are the designations by which most of the moroccos made are known.

The tanning is done in the old way, and by what is known as the "bag" process, in which the skins are first sewed by hand or machine and the sumac and sumac liquor forced inside. The open tan process, by which system the skins are hung in the liquor, is being gradually adopted. Machinery is largely employed in the tanning and finishing of moroccos, excepting on the finer grades, in which the work is still largely done by hand. With the general introduction of steam the drying of skins is greatly facilitated, and there is no such enforced dependence upon the eccentricities of the weather as was the case years ago.—*Shoe and Leather Reporter.*

CEMENT FOR COATING ACID TROUGHS.—Melt together 1 part pitch, 1 part resin, and 1 part plaster of Paris (perfectly dry).

A New Wind Engine.

Mr. W. Thomson, Professor of Mechanical Engineering in the Iowa College of Agriculture, describes, in the *College Quarterly*, a new windmill, which has been recently constructed and put in use at the above institution.

From the following description any mechanic can construct a windmill on the Professor's plan, and according to his testimony it is an entire success.

Previous to the fall of 1878, the water was forced to the several departments of the college by a No. 7 Knowles pump, running on an average of four and one half hours each day. The height to which the water has to be raised in the main building is 106 feet 7 inches—the amount required here being about 6,000 gallons in twenty-four hours; the other departments require about 2,000 gallons in the same time, which has to be raised to an average height of about fifty feet. The cost by this system (coal delivered at the well for $3.20 per ton, and firemen's wages being 61 cents per day), averaged about $45 per month.

It is evident that a wind engine would do this work cheaper than steam, since, in raising water, there is no objection to a variable motion. From a study of the various kinds, and their construction as to efficiency and durability, says Professor Thomson, it was evident that the greatest efficiency of the acting cylinder of wind was not reached by the mills in use at the present time. We therefore concluded to construct one that would fulfill this condition as nearly as possible. Knowing the amount of work to be done, and allowing for friction in the pipe, and for waste and leakage at the different points along the line from which water is drawn, and assuming the velocity of the wind to be fourteen feet per second, and that the efficiency would not be less than thirty-three per cent of the acting cylinder of wind, it was shown by calculation that a wheel eighteen feet in diameter would do the work and furnish an ample supply as long as the above velocity was maintained. During the fall and winter this wheel was made and set in position ready for the work in the spring. The construction is as follows: The arms are eight in number, made of wood and bolted to a spider which is keyed to the crank shaft. The pieces to which the vanes are fastened are circular arcs of iron, and are fastened to the arms by being bent at the ends radially and toward the center; bolts passing through these ends and the arms, thus fastening them securely together. There are sixty-four vanes, seven feet long, four and one half inches wide at the center end, eleven inches at the tips, and are fastened to the circular arcs by clips which are riveted to the vanes and bolted to the circular arcs. The vanes are made of iron for the following reason: In order to get from the wind the greatest amount of work, they should be curved or twisted from the center to the tips, the amount of twist depending upon the length. They are also made slightly concave on the face, in order to cause the stream of air to leave the vane at as near a right angle as possible to the direction that it has when it first strikes it, and this curvature can be more readily given to iron than to wooden vanes. By making the clips of the proper length the desired amount of twist was given to them, the angle at the center being about 45° and at the tips 25° to the plane of rotation. That this form of vane is instrumental in taking from the wind the greater part of its living force, is evident from the fact that back of the wheel, even when a high wind prevails, there is but little motion in the air discernible. In order to make the wheel strong and rigid, it is trussed by half inch rods in front and back of the arms. The shaft is two and one-eighth inches in diameter, and has a crank forged on it with bearings on both sides of the crank. These bearings are on a large hollow cylinder, through which the connecting rod passes to the pump rod, which is made of one inch iron pipe and answers well, as it can be readily connected and disconnected when desired.

The pressure on the pump due to the height is 48 lb. per square inch; this is shown by calculation and also by a pressure gauge at the surface of the water in the spring. This gives a pressure on the crank of 336 lb., the diameter of the pump barrel being 3 inches and stroke 6 inches; the force of the wind at the assumed velocity and efficiency would be 560 lb., and the corresponding velocity of rotation is about twenty revolutions per minute; amount of water raised, twenty barrels per hour. The amount of water raised is much more than these figures would indicate. It is also evident from the performance of the wheel that a less velocity than that assumed will run it, and it is often remarked that that mill will run without wind.

If only one half of the above result was obtained, it would still pay to run the mill in connection with the steam pump; but since the first of March, the amount required has been furnished by the mill with the exception

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of a few hours' run with the steam pump. The amount saved over the old system is not less than $35 per month.

The problem of economy so far, then, has been solved and that of efficiency practically demonstrated.

Moss on Grass Lawns.

It is generally thought that a damp, undrained bottom is the cause of moss on grass lawns, but by some it is regarded as proceeding in a great measure from poverty of the soil, for where grass grows freely this parasite is rarely if ever found. To effect a riddance of this pest there is nothing equal to fresh-slaked lime and wood ashes mixed—so writes a correspondent in *Land and Water*—which, he states, not only kill it and cause it to shrivel up, but have a most beneficial result on the lawn by stimulating the natural herbage. Where this is really poor and needs assistance I would strongly recommend the use of both the above named, together with the addition of soot and finely sifted soil, which mixture is far better than guano, nitrate of soda, or other patent manures, that force too much growth for a time, only to be succeeded by increased exhaustion soon after. The first proceeding, however, to cure a mossy grass path should be to scarify it well over with an iron toothed rake, followed by a good sweeping after with partly used-up brooms, which will make way for seeds to be sown, and these should be worked in by using the rake as before. This done, the soil mentioned and the ingredients with it will then come in for affording an additional covering, under which it will germinate, and, once through, make rapid progress.

Etna in Eruption.

At the beginning of the current month great anxiety prevailed with regard to the rapid increase in the volume of lava pouring out of the craters of Mount Etna. Craters had formed on two slopes, and a double eruption was in progress. On the night of May 28 a number of brilliant balls of fire were thrown to a great height and burst aloft like rockets, emitting a fiery shower.

Later, fresh craters opened, endangering Bianca Villa, Randazzo, and Castiglione. Clouds of ashes overhung Piedmont, which was in almost total darkness. The Aci Reale and Catania Road was blocked and considerable damage had been done.

By the 2d of June a considerable portion of the bed of the Alcantara River had been covered by the lava. The damage to agriculture was already very serious. The inhabitants had been forced to abandon the village of Majo. Many large and valuable estates had been destroyed. The four main craters continued to pour forth streams of lava, while many of the smaller ones had become inactive. The stream of lava which had interrupted the road at Passa Pescaro was half a mile wide and a hundred feet deep.

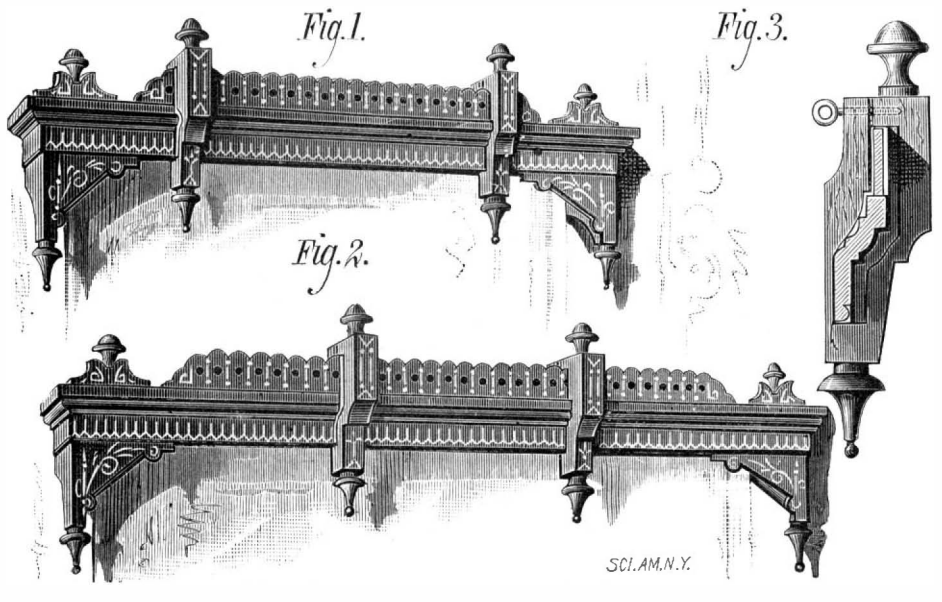
IMPROVED WINDOW CORNICE.

Any one who has had occasion to change his residence knows too well that what will do for one house will not answer for another. The furniture, carpets, and fixtures need remodeling to adapt them to their new situation. Not the least among annoyances is the variation in the width of windows, necessitating a change of shades and curtains and also of cornices, the latter being usually fully as expensive as either of the other items, and incapable of being adapted to a window narrower or wider than it was originally designed for.

To obviate these difficulties as well as to enable makers and dealers in window cornices to fit any kind of window without making a cornice especially for it, Mr. James W. Campbell, of No. 9 Baxter street, New York city, has devised the extension cornice shown in the accompanying engraving.

It consists of two thin mouldings, fitted one over the other, and arranged to slide and thereby lengthen or shorten the cornice to adapt it to any window. The vertical pieces or trusses are attached one to the inner end of each sliding piece, and they are split at their upper ends, and provided with a clamping screw, by means of which the parts may be fixed after they are properly adjusted. The trusses are lined with felt or flannel, as shown in Fig. 3, to prevent marring the face of the mouldings. Fig. 1 shows the cornice closed together. In Fig. 2 it is represented as extended.

These cornices are not restricted to any particular style of moulding or finish, and their form is always symmetrical. Further information may be obtained from the patentee, whose address is given above.



CAMPBELL'S IMPROVED WINDOW CORNICE.

THE MEXICAN EXHIBITION IN DOUBT.—The work of preparation for the proposed Mexican Exhibition has been stopped, and it is believed that the Mexican Cabinet has determined to abandon the enterprise for lack of means.

NEW COMBINATION TOOL FOR MERCHANTS.

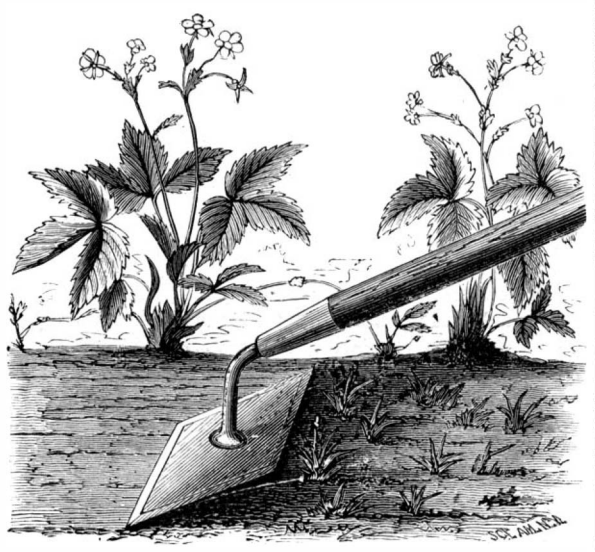
The accompanying illustration will scarcely need explanation, as the merits and usefulness of the article will readily be seen by those who have frequently to pack or open boxes or packages of merchandise. The tool combines in very simple form a hammer pincers, and wrench. When it is used as a nail extractor a driver, which is not shown in the engraving, is used for forcing the jaws into the wood.

This tool seems to combine the advantages of the more costly implements for a similar purpose. It was recently patented, and is being manufactured by Messrs. W. K. Smith & Co., of Kirkville, Mo.

SMITH'S COMBINATION TOOL.

A NEW SCUFFLE HOE.

The improved implement shown in the accompanying engraving is designed to take the place of the ordinary hoe in various gardening operations, but it is more especially adapted to such work as the cultivation of the strawberry and other similar plants, and to weeding onions, etc.



MUNSON'S SCUFFLE HOE.

The implement has been used for a number of years by the inventor in his own market garden, where he has proved to his own satisfaction that the men who use it can accomplish three times the work possible with an ordinary hoe. It may be used as a subsoiler, as it will readily break up the soil to a depth of five inches without great exertion on the part of the user, and it is stated that it is not at all difficult to make, in ordinary soil, strokes of five feet. It answers an excellent purpose in weeding onions and other plants growing in drills or rows, as it completely uproots the weeds and renders unnecessary any work with the hands. As a strawberry hoe it may be pushed around and under the vines without injuring them, and by inverting the blade it forms an efficient runner cutter, and it may also be used to set runners to root.

The great advantages possessed by this implement over others of its class are that it may be used without bending the back, and much less force is required to work it.

The general appearance of the scuffle hoe is shown in the engraving. The blade is diamond-shaped, and is curved, having its convex surface uppermost. The edges are beveled or sharpened, and the curved shank which receives the handle is secured to the center of the blade.

This invention was recently patented by Mr. T. V. Munson, of Denison, Texas, from whom further information may be obtained.

ENGINEERING INVENTIONS.

Messrs. Philo A. and Ira S. Knapp, of Danbury, Conn., have invented an improved cut-off for steam engines in which the valve is arranged so that it will close the live steam port at one third, half, or two thirds of the stroke, while the exhaust port remains open to the end of the stroke.

An improved railroad gate has been patented by Messrs. Henry Hahn and Anderson L. Gaston, of Gainesville, Texas. It is intended to fill up the gaps in fences crossing the railway track. It is lowered by the passing trains from either side, and is raised as soon as the train has passed over it.

Mr. Henry Ruse, of Baltimore, Md., has patented an improvement in railway ties. In a track formed with these ties two permanent clamping lugs of any one tie project in the same direction, but are arranged upon opposite sides of the rail from the permanent lugs of the next tie. The inventor also provides a peculiar locking device, by which important advantages are secured.

An improved car coupling has been patented by Mr. Geo. W. Cushing, of Sedalia, Mo. The object of this invention is to furnish a more efficient and durable substitute for the plate springs and other devices that are now used on that class of draw hooks that require side pressure to retain them in position.

Color Blindness.

That the prevalence of color blindness among railway employes, and the consequent danger, were not overrated by us in our early articles on this subject, continues to receive abundant confirmation. Dr. Keyser, of Philadelphia, according to the *Railway Review*, has examined the eyes of the train hands of three Philadelphia railways, and finds that three and one half per cent are color blind. These cannot discern the difference between colors; and in addition there are eight and one half per cent who can distinguish colors, but cannot distinguish shades of the same color apart. There are thus twelve per cent who have not that quickness and accuracy of perception of colors which should be considered absolutely necessary in the railway service, as long as signaling is done by means of colored lights. It is fair to presume that general investigation would show about the same results.

A Great Russian Telescope Projected.

At a meeting of the Naval Institute in Washington, May 29, Professor Newcomb stated that he has received letters from Otto Struve, Director of the Pulkowa Observatory, announcing that the Russian Government has voted 250,000 rubles for the construction of the largest telescope that can be advantageously made, including the building in which to mount it. The object glass is intended to be between thirty inches and three feet in diameter, if the glass makers find it practicable to cast a disk of this size of the necessary evenness and purity.

It has not yet been decided who shall undertake the most difficult part of the work, the grinding of the glass; and before deciding it Strune intends to visit this country in order to examine the Washington and other great telescopes made by Alvan Clark & Sons. He will probably arrive here for this purpose some time during the summer. Should his examination prove satisfactory he will be ready to open negotiations with the Clarks for the work if he is sure it will be done enough better to warrant the risk of sending the glass twice across the Atlantic.

Molecular Oscillations.

M. Raoul Pictet, of Geneva, one of the two chemists who not long ago were so brilliantly successful in liquefying hydrogen, has recently been engaged in researches which deal with some of the most delicate problems in molecular physics. He has endeavored to determine the length of the molecular oscillations of a body subjected to the action of heat. No explanation is given as to the method of calculation employed, but M. Pictet arrives at the remarkable result that the product of the length of molecular oscillation by the temperature of fusion is constant in all solid substances. He adds that the higher the

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temperature, the shorter are the oscillations. Here are some of the figures: Selenium, 3·7, lead, 3·3, zinc, 3·5, silver, 3·8, copper, 3·4, gold, 3·4, iron, 3·3, platinum, 3·6. These numbers are evidently near enough together to warrant the statement that the law of constancy is here verified with conditions of exactness comparable to those which Dulong and Petit declared satisfactory in their researches on specific heats.

RECENT MECHANICAL INVENTIONS.

A machine for laying bands or stripes of color around broom handles, which does its work rapidly and neatly, has been patented by Mr. Solomon Lang, of Schenectady, N. Y. The machine is fitted to carry two handles and two sets of striping brushes, which act alternately, so that while one handle is being striped the other may be removed and replaced by another.

Messrs. A. H. Simms, of Nixburg, and J. L. Porter, of Rockport, Ala., have patented an improved rope measuring machine. It consists in the arrangement of a measuring wheel provided with an alarm device for indicating its revolutions, and in a semicircular receptacle for containing the rope to be measured.

Mr. John G. Meeker, of Danbury, Conn., has patented an improved machine for filling and hardening hat bodies and other fabrics. The invention consists in forming ribs of hempen rope upon the opposite working faces of the filling roll and apron of a machine for fitting and hardening hat bodies.

American Hardware in British Colonies.

The *Ironmonger* continues to lecture the English manufacturers for their apathy in not bestirring themselves to prevent the introduction of American manufactures into the British colonies.

There would appear to be much reason, says the editor, for fearing that English manufacturers are not even yet fully alive to the extent and nature of the competition they have to meet and fight. Through our own columns, for instance, attention has repeatedly been called to the subject, and we have been careful to give, from time to time, the latest and most authentic information obtainable. It has been shown more than once that our colonists in Australia, New Zealand, the Cape, and elsewhere are rapidly developing an amount of business in American hardware which was not even contemplated half a dozen years ago. They are well and attentively served by the manufacturers of the United States, and appear to be disposed to transfer to them many of their commissions. They tell us directly, or indirectly, that they are more thoroughly satisfied by their new providers than by our own traders, and we cannot blame them, therefore, if they continue to divert their favors into transatlantic channels. They would, and do, prefer to have English made goods of all kinds, but they find that the patterns, finish, and packing of the Americans are frequently so superior that they are literally compelled to cease doing business with us. In not a few instances they still send their indents to England, but they specify American goods, and decline to be put off with any others. They are, as our correspondent tells us, often charged nothing for packages, and have everything so carefully wrapped up or boxed, marked, and labeled, that they find far less trouble in retailing the goods than those sent to them from this country. We have before remarked that there is not the slightest reason why this state of things should continue. We are able to compete successfully with the whole of the outside world, either as regards quality, quantity, or price, and it ought not to be publicly stated that we do not do so. We have every advantage on our side, and it is nothing less than a notorious scandal if we neglect our opportunities any longer. As a nation we are compelled to manufacture, and inasmuch as we produce immensely in excess of our internal consuming powers we must continue to export the surplus. It is, therefore, not merely our interest, but an absolute necessity, that we should consult the tastes and requirements of our customers, and by the exercise of enterprise, tact, and progressive tendencies, keep ourselves in that foremost position we have so long held. The time for apathy, indifference, and adherence to obsolete patterns or practices has gone by, never to return. The recognition and full appreciation of these facts ought to be sufficient to put our manufacturers and merchants on their mettle to such an extent as to render the continuance and repetition of these complaints impossible and unnecessary.

Copper and Iron Lightning Conductors.

What should be the relative sectional areas of lightning rods in order that neither metal should be more liable to fusion by the passage of an electrical discharge through it than the other? Mr. R. S. Brough (whose recent death in India we regret to announce) has answered this question in the May number of the *Philosophical Magazine*. The relation usually given—viz., that an iron rod should have four times the sectional area of the copper rod—is based on the fact that copper conducts electricity six times as well as iron, while the melting point of iron is about 50 per cent higher than that of copper, and $\frac{6}{1{\cdot}5} = 4$. This simple treatment is incomplete, because it neglects the following important factors: (1) The influence of the rise of temperature in increasing the electrical resistance of the metal; (2) the difference between the specific heats of the copper and iron; and (3) the fact that the iron rod being made several times more massive than the copper rod, it will require a proportionally greater quantity of heat to increase its temperature. Taking these considerations into account, Mr. Brough finds that the sectional area of an iron rod should be to the sectional area of a copper rod in the ratio of 8 to 3. For the same efficiency iron rods are therefore cheaper than copper rods.

PREVENTIVE FOR SLIPPING BELTS.

Mechanical engineers and users of machinery know only too well that all belts slip more or less, thereby occasioning a loss of both power and motion as well as the wearing of the belt. Several remedies have been suggested and tried such as the application of rosin and other adhesive substances to the belt or pulley, but none of them, so far as we are aware, with the exception of the device shown in the accompanying engraving, have proved of any practical value. In fact the application of adhesive substances is

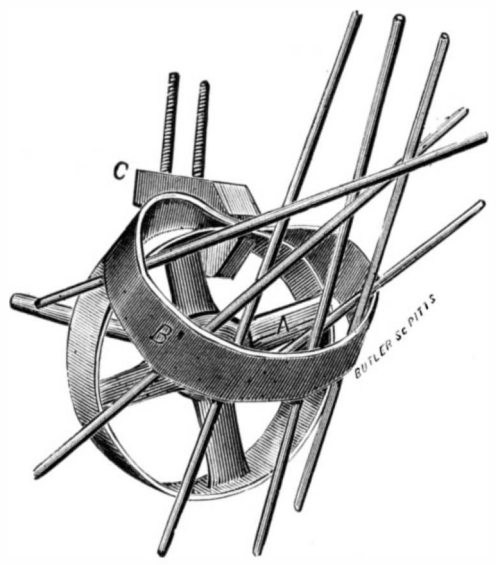

Fig. 1.—SUTTON'S PATENT PULLEY COVER.

productive of a direct loss of power, and injury to the belt. To secure the required amount of friction by tightening the belt brings greater pressure and consequent friction upon the journals and increases the strain and wear on the belt.

The pulley cover shown in the engravings is designed to obviate all of these difficulties and greatly increase the transmitting capacity of both belt and pulley. It is simply a flat endless band of elastic rubber and canvas, made about one inch to the foot shorter than the circumference of the pulley, with the inside face unvulcanized. It is stretched around the pulley and cemented fast.

The manner of applying the cover is shown in the engravings. After cleaning the pulley the cover is clamped to the upper part of the pulley by means of an ordinary hand screw, then a number of rods are inserted in the cover and placed against the rim of the pulley, as shown in Fig. 1. Three or more men, taking one rod in each hand, stretch the covering outward and place it on the pulley, as shown in Fig. 2; then all of the rods but one are removed, and the

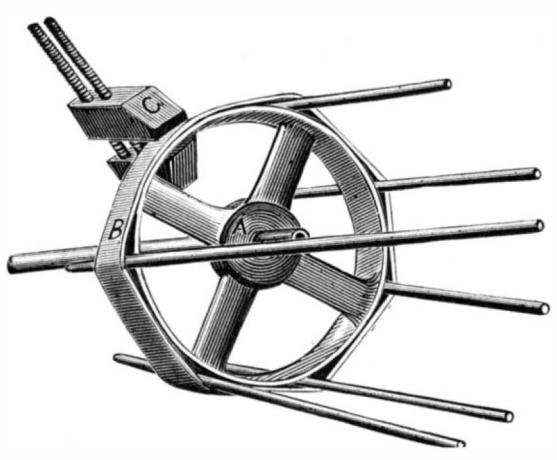

Fig. 2.—PULLEY COVER.

hand screw is taken off; cement is placed between the cover and the pulley as the remaining rod is rolled around the pulley under the cover. When all sides of the pulley have been cemented the rod is removed, and the cement is allowed to dry.

The manufacturers assert that this cover effects a great saving in power, and that a pulley having this cover applied has at least double the capacity of a plain pulley of the same dimensions.

Further particulars may be obtained from Joseph Woodward, room 11, 55 Liberty street, New York (P. O. box 3419).

The Nature of Plastic Substances.

At a recent meeting of the Philadelphia Academy of Natural Sciences, Dr. Koenig referred to a statement made by him some time ago when speaking of the composition of the so-called mountain soap of California, that the plastic components thereof are not crystallized substances. As this was contrary to the opinion held by certain authorities on such matters, he had been led to give the subject further consideration, and he was now prepared to sustain his original assertion, although it was at first based simply upon analogy. He believed that in the inorganic, as in the organic kingdom, no plastic substance is crystallized. The substances pholerite and necrite, which have indeed the same quantitative and qualitative composition as the plastic kaolinite, are indeed crystalline, but these are simply cases of polymerism. In the course of his investigations on the nature of clays he had studied the sediment thrown down by slightly turbid river water. If portions of this substance be again dissolved and the redeposit examined under microscope, it will be found to present the appearance of starch. The granules are transparent, and may be examined by polarized light, when it will be found that they are not at all crystallized. Further investigations of the subject are promised.

Emigration to the United States.

Probably from its comparative nearness, and the social and personal freedom it promises, as well as from the fact that so many of the working classes have "some friend or brother there," emigration to the Transatlantic Republic has always been much in excess of that to our own colonies, even to the adjacent Dominion. But for some years there has been a great commercial depression in the United States as in the United Kingdom, and during the past quinquennial period as much slackness in emigration as in everything else. The turn of the tide has, however, come at last, and it is doubtless a sign that a decided improvement has set in over the water. Both from the Clyde and Mersey, as well as from other less important havens, flocks of emigrants are leaving these shores. Nearly 11,000 persons left Liverpool to go into voluntary exile last month, of whom 8,931 were bound to the United States, 1,723 to British North America, and only 48 to Australia, 6,015 altogether over those of March, and 4,090 over the corresponding month of last year; while during the present May there is every prospect of numbers leaving several thousands in excess of the corresponding month for many years past. Of the April emigrants, 5,348 were English, 1,546 Irish, and only 58 Scotch. —*Iron.*

Phosphorescent Photographs.

To Mr. Woodbury's inventive ingenuity we owe this plan, which has been tested, and is a practical success. The method he employs is known as the "dusting-on" process. It consists in coating a plate with a preparation of dextrine, honey, and bichromate of ammonia, which, exposed under a negative, becomes hardened, where it is subjected to the action of light, through the transparent parts of the negative, remaining tacky where it is protected from the action of light by the denser parts of the negative. After exposure under a negative, the film, as it will be seen, is tacky in the lights of the picture, but hard and dry where light has acted on the shadows. The lights are therefore adhesive and tacky, retaining any fine powder which is dusted in or rubbed into the moist surface. At this point comes in the essential novelty. The powder to be used must be a phosphorescent substance. One of the best known and available is sulphide of calcium. A powder of this substance is applied to the image formed on the adhesive film, and sticks to it in due gradation of the tackiness, as regulated by the action of light which passed through the negative. An image of sulphide of calcium is thus formed, which, the powder being nearly white, is scarcely visible by daylight, but if the image be submitted for a time to sunlight, or bright daylight, or brilliant artificial light, and then taken into the dark, presents a luminous picture, somewhat startling, indeed, in the case of a portrait.

A variety of substances possess this phosphorescent quality: sulphides of barium, calcium, and strontium displaying it in the most marked degree; fluorspar, carbonate of lime, pearls, diamonds, phosphate of lime, arseniate of lime, and other substances, all showing in their degree this capacity of absorbing light and radiating it in the dark. The Bologna stone, consisting of sulphide of barium, displays this property in a marked degree. The old Italian cobbler to whom tradition assigns the discovery of the property of this stone, and its use to astonish his friends and neighbors, prepared it by heating red hot with charcoal a piece of sulphate of baryta, found plentifully in the neighborhood of Bologna. Sulphate of baryta made into a firm paste with gum, or with flour and water, and calcined, will produce the substance. It should be kept sealed in a stoppered bottle.

The phosphorescent property has been utilized in America for the production of luminous clock and watch faces, which readily show the hour in the dark. Professor Morton, in the SCIENTIFIC AMERICAN, points out the possibility of superseding gas or other incandescent substances as means of illumination by having the walls of a room treated with a phosphorescent substance, which might absorb sufficient light during the day to serve for illumination at night. Dr. Phipson points out that a whitewashed cottage exposed during the day to strong sunlight sometimes shines at night with a brilliant phosphorescent light; pure lime or a mixture of lime and nitrate of lime possessing the property in question. The substance used in preparing luminous clock faces is sulphide of calcium, sometimes known as Canton's phosphorus, Canton having prepared it by heating a mixture of three parts of calcined oyster shells with one part of sulphur to an intense heat for an hour. It may also be formed by heating.

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gypsum with charcoal. The most refrangible or actinic rays are most active in producing this phosphorescence, or fluorescence.

Mr. Woodbury, so far as we know, is the first to give this property a practical purpose in photography. He applies the sulphide of calcium in powder to the image formed by light on a surface possessing an elective degree of tackiness, and the image being so formed and submitted to the action of sunlight, or even a good artificial light, presents a luminous picture in the dark. Used with judgment, such portraits may be found very interesting, while, perhaps, nothing could be more ghastly than the unexpected presentment of such a portrait of a deceased friend.

To those of our readers who may desire to study the question of phosphorescence generally in connection with this subject, we cannot recommend any better assistance than the very interesting work on "Phosphorescence, or the Emission of Light by Minerals, Plants, and Man," issued by Dr. Phipson a few years ago.—*Photographic News.*

PRACTICAL DIVISIBILITY OF THE ELECTRIC LIGHT.

[*Continued from first page.*]

A single electric lamp placed near the current generator supplies light for a building or a street. This lamp is surrounded by a system of lenses and reflectors forming a chamber of light, as represented in Figs. 2 and 3. These lenses concentrate the whole of the light into as many beams of parallel rays as there are faces in the chamber. In this form the light may be projected through long distances. The intensity of the light when not condensed is inversely proportional to the square of the distance from the source of light, but when the light is projected in parallel rays and is prevented from radiating, its intensity remains unchanged, except perhaps a small loss by the absorption of the atmosphere.

From every face of the chamber of light a box or pipe projects, which incloses the light beam. These pipes are laid along the streets, as seen at T in the larger engraving, and they are placed along the walls and floors of the building.

At every side street a smaller pipe branches out of the main one, and at their junction there is a reflector, which, by its size and position, will divert into the side street any desired percentage of the entire light. By means of this device every street in a city may be provided with one or more pipes carrying a certain amount of light that is always controllable by merely changing the position of the reflectors. This arrangement may be compared to valves and water gates of a system of water distribution.

Service pipes lead from the street pipes to the lamp posts and to the buildings, and at the intersection of the service pipes with the street mains there is a reflector, the size of which will determine and control the amount of light supplied by the service pipe.

The larger engraving shows, at T, the street main pipe and light beam, A. B is a reflector or totally refracting prism, which sends a portion of the main beam of light into the service pipe, B C, which, in the present case, supplies both the street lamp and the building. Another reflector or prism, *b*, bends a portion of the supply beam upward into the lamp post; this vertical beam strikes a reflector of suitable shape, which diffuses the light as may be required, the manner of diffusion depending of course on the form of the reflector.

The horizontal light beam, B C, reaches the vertical supply pipe, C F, laid along the wall of the building, and the reflector at the juncture of these two pipes bends the beam upward.

At D, E, F, there are other reflectors, each of which, according to their size and position, will bend horizontally the amount of light required for each floor. These smaller beams are projected through pipes laid along the floor joists. The horizontal beam, D *d*, is partly intersected by a reflector at *f*, which bends downward a portion of the beam which enters the room below through a diffusing lens (shown in detail in Figs. 4 and 5), called by the inventors a secondary lens, which sheds the light in any predetermined direction, according to the shape and curvature of the lens. The remaining portion of the beam passes on to illuminate other rooms, including the hall above, which receives its portion from a reflector at *d*.

The arrangement just described is duplicated on the other floors and modified to conform to the varying requirements of the different stories.

When it is desired to distribute light to rooms not in line with the main pipes, a double reflector may be used to divide the principal beam into two lateral ones, which will illuminate two or more adjoining rooms.

It will thus be seen that all of the rooms in a building may by illuminated by a single beam, and that the light may be divided without material loss. The reflector, B, controls the supply of light for the entire building, and the amount of light may be regulated or it may be shut off altogether by moving the reflector. In like manner the reflectors, D E, will control the light for their respective floors. If they are stationary the percentage of light for each floor will be constant, but if either of them is arranged to slide into and out of the light tube, it will vary the amount of light supplied to the corresponding floor at the expense of the other floor. The light in any of the rooms may be increased or diminished in a similar way. The reflectors are sometimes arranged to slide laterally, so as to increase the light or decrease it to a mere glimmer, or even shut it off altogether without affecting the light supply of the other rooms. In the left hand rooms there are at *m m' m''* cords or handles connected by cords or wires to the prisms or reflectors, which, being pulled or turned more or less, will slide the prisms or reflectors; in this way the light may be perfectly controlled with less effort than is required to turn a gas key.

The secondary lenses, which are shown in detail in Figs. 4 and 5, are made movable, and a set of two or more of them is supplied to every room. These lenses are moved by the cord, P, which is connected with one of the handles, *m*. By moving the handle either of the lenses may be brought into line with the beam of light. These lenses will diverge the light more or less according to their curvature, so as to illuminate a part or all of the floor, or the entire floor and as much of the walls as may seem desirable.

The lenses, in addition to the sliding motion, have a swinging motion, by means of which the light may be projected in any required direction, rendering it unnecessary to place the table exactly under the lens. The inventors state that these lenses will answer for all household purposes, and that by means of lenses of different kinds a very wide range may be given to this system of lighting; for example, if a condensing lens is employed the light will be concentrated at a single point, so that it may be used to advantage by the microscopist. If no lens is employed the beam of parallel rays may be used in the magic lantern and in other apparatus for projection. It may also be employed in philosophical experiments, in medical examinations, and surgical operations. There are many branches of industry, now requiring daylight, which could be conducted in the night by means of the condensed light.

Another advantage in this system is that the color of the light, as well as its intensity, may be readily modified by means of colored glass slides. This is especially convenient in photography, where lights of different colors and of differing actinic power are required. This feature will also render the light valuable in treating ophthalmic diseases at home and in hospitals. There are many uses to which this system of lighting seems adapted, which, for want of space, cannot be mentioned.

As to economical advantages it will be noticed that regulators or lamps are entirely dispensed with, and that attendance is consequently not required.

Another important feature is that a large generator of electricity may be employed, thereby greatly reducing the cost of the production of the electrical current. The loss consequent upon the use of electrical conductors is entirely avoided, as the single lamp needed is located near the generator, permitting of the use of a short and thick conductor having practically no electrical resistance.

A great advantage in having only a single lamp for a large system is that a vacuum may be maintained in the chamber of light without difficulty, thereby preventing the rapid combustion of the carbon, which always occurs when the electric arc is maintained in air. The cost of the carbons, as well as the labor of replacing them, which, in the ordinary electric regulators, is something considerable, is entirely avoided.

Besides being adapted to the illumination of large and small areas, this system of lighting appears peculiarly suited to certain applications for which other lights are totally unfit; for example, mines may be safely illuminated without fear of explosion and without increasing the temperature or vitiating the air. In warehouses, storerooms, powder works and magazines, chemical factories, and the like, this system can be used with perfect safety. It is also adapted to the illumination of railroad tunnels and similar places.

Messrs. Molera & Cebrian exhibit some very flattering figures based upon an expenditure of twenty horse power, which, as we have already learned, is not sufficient to obtain the most advantageous results. They claim that they are able to produce by their system 195 lights per horse power giving a light equivalent to 1,958 candles, and that the cost of lighting is less than one twentieth the cost of gas.

The lamp used in connection with this system is so clearly represented in the engraving as to require little explanation. Fig. 2 is a perspective view, and Fig. 3 is a vertical section.

Chamber G, before referred to as the chamber of light, is surrounded on the sides and top by lenses, L. At the bottom there is a concave reflector, H, and at the center two carbon rods converge. These rods are supported by pistons or floats in inclined tubes, J, which are connected at their lower ends by a horizontal tube communicating with the spring acted bellows or cylinder, K. The tension of the spring that draws the top of the bellows down, may be changed by revolving the small windlass, S.

The top of the bellows is iron, and above it is supported an electro-magnet, which is in the electrical circuit. The carbons pass between conducting surfaces, and are also in the electrical circuit. The tubes, J, as well as the horizontal tube and the bellows, are filled with a suitable liquid. As the current passes from one carbon point to another the core of the electro-magnet becomes magnetized and attracts the head of the bellows with more or less force, maintaining a uniform light by governing the distance between the carbons by displacing the liquid in the tubes and throwing the pistons or floats up or down, according to the strength of the current.

Should the current cease the spring draws down the head of the bellows and the points of the carbons touch. When the current is too strong, the top of the bellows is attracted upward, and the carbons separate.

Rats in Brazil.

Mr. Orville A. Derby contributes to the *Rio News* some interesting information on the plague of rats in Brazil. From time to time in all parts of Brazil the plantations are subject to the depredations of armies of rats that issue from the forests and consume everything edible that comes in their way. During a recent excursion in the province of Paraná Mr. Derby found an almost universal lack of corn throughout the province, due to such invasion of rats, by which almost the entire crop of last year had been destroyed. This invasion, or plague as it is called, is said to occur at intervals of about thirty years, and to be simultaneous with the drying of the *taquara*, or bamboo, which everywhere abounds in the Brazilian forests. The popular explanation is that every cane of bamboo sprouts with a grub, the germ of a rat, within it, and that when the bamboo ripens and dies the germ becomes a fully developed rat and comes out to prey on the plantations.

An educated and observant Englishman, Mr. Herbert H. Mercer, who has resided a number of years in the province and had an opportunity of studying the phenomenon, furnished Mr. Derby the following rational and curious explanation: The bamboo arrives at maturity, flowers, and seeds at intervals of several years, which doubtless vary with the different species. The period for the species most abundant in Paraná is thirty years. The process, instead of being simultaneous, occupies about five years, a few of the canes going to seed the first year, an increased number the second, and so on progressively, till finally the remaining and larger portion of the canes seed at the same time. Each cane bears about a peck of edible seed, resembling rice, which is very fat and nourishing, and is often eaten by the Indians. The quantity produced is enormous, and large areas are often covered to a depth of five or six inches. After seeding the cane dies, breaks off at the root, and falls to the ground, the process of decay being hastened by the borings of larvæ which live upon the bamboo and appear to be particularly abundant at seeding time. These larvæ have doubtless given rise to the story of the grub developing into a rat. New canes spring up from the seed, but require seven or eight years to become fit for use, and thirty to reach maturity.

With this sudden and constantly increasing supply of nourishing food for a period of five years, the rats and mice, both of native and imported species, increase extraordinarily in numbers. The fecundity of these animals is well known, and the result after four or five years of an unusual and constantly increasing supply of excellent food and in the absence of enemies of equal fecundity, can readily be imagined. The last of the crop of seed being mature and fallen to the ground, the first rain causes it to decay in the space of a very few days. The rats, suddenly deprived of food, commence to migrate, invading the plantations and houses and consuming everything that does not happen to be repugnant to the not very fastidious palate of a famishing rodent. If this happens at the time of corn planting, the seed is consumed as fast as it can be put into the ground. Mr. Mercer, who plants annually about fifty acres of corn, replanted six times last year, and finally gave up in despair. The mandioca is dug up; the rice crop, if it happens to be newly sown or in seed, is consumed, as is also everything in the houses in the way of provisions and leather, if not carefully guarded in tin trunks.

A Permanent Exhibition in Boston.

It is reported that the New England Manufacturers' and Mechanics' Institute is completing the erection of a suitable building for the permanent exhibition of the industrial products of New England, with stated fairs and special exhibitions. The proposition is to make each exhibitor pay a small rental for the space occupied, and to distribute the interest in the undertaking as widely as possible throughout New England, the shares being put at twenty-five dollars, and no one man allowed to take over four shares. A fair will be held as soon as a place and funds are secured, and thereafter annually, beginning the first Wednesday of September.

When America was Named.

The Lenox Library, in this city, is very rich in old books, many of them relating to the discovery of America. Among these is the "Cosmographiæ Introductio" of Hylacomylus, printed in 1507, in which the name of America was first suggested for this continent. "Hylacomylus" was the Hellenized form of the name of Martin Waltzmüller, a professor in the gymnasium of St. Die, in Lorraine. In this "Cosmographiæ Introductio," on the fifteenth leaf, appears the suggestion which named the continent, of which the following is a translation: "But now that those regions have been more extensively described and another fourth part has been discovered by Americus (as will appear in the sequel) I do not see why it should not be named America, that is the land of Americus, after its discoverer, Americus; a man of sagacious mind, since both Europe and Asia took their names from women." The popularity of this early geography led to the immediate adoption of its author's suggestion, and the new continent was called America by other writers.

CURE FOR HICCOUGH.—Under this title Dr. Grellet, of Vichy, states that he has never failed in immediately relieving hiccough, *i. e.*, not dependent upon any appreciable morbid condition, by administering a lump of sugar imbibed with vinegar.—*Revue Medicale.*

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A Careless Meteor.

In the northwest corner of Emmett county, in the township of the same name, State of Iowa, bordering Minnesota State line, a meteor of unusually large dimensions recently fell. A correspondent of one of our Western contemporaries, who has visited the place, thus describes the meteor and the scene attending its descent:

It was about 5 o'clock in the afternoon that a terrible, indescribable noise was heard, scaring the cattle and terrifying the inhabitants for twenty miles about. There was a line of yellow-reddish smoke-colored haze, inside of which was an infernal rumble, as, at the rate of fifty miles a second, this strange, howling monster, or wonder, came to ward the earth with a roar and a crash that fairly shook the earth.

Before it struck there was an explosion terrible, to hear and suggestive of the final dissolution of all things, and then, with a shock and a thud, something struck. Men ran to the spot to find that, at a point within thirty feet of the county line, the sod had been torn as though ripped by lightning, and that a hole was left in proof that something had gone in there out of the way. Chunks of sod were thrown forty rods away from the hole, which, on being dug into to the depth of fifteen feet, ten feet of which distance was in solid blue clay, revealed a lump of metal resembling iron mixed with silver. The hole was dug larger, and by means of chains the mineral was taken out and found to weigh 431 lb. It is two feet long and about sixteen inches square, if a ragged chunk can be called square. Another chunk, weighing 32 lb., fell not far distant, plowing up the sod within twelve rods of the school house near the residence of John Barber. Another piece, weighing 156 lb., was found bedded five feet in blue clay.

There is trouble here over the find. One man, who owns the land, declares that the property is his, while the man who first found it says it is his by right of discovery. The same is the case in each instance. Suits at law have been entered by the owner of the soil against the men who dug them out, and who have hidden their treasure where the officers of the law, as yet, cannot find them.

These are the facts. Now what is the thing that fell, and where did it come from? S. N. R.

To this the editor of the La Crosse *Democrat* replies that it was undoubtedly a meteor, or a fragment of a comet thrown out by explosion: and following its orbit perhaps for thousands of years, till, losing its momentum, it came within the atmosphere of the earth, and was then, cooling as it whirled through space, attracted to the earth, and, rushing with terrible speed, drove itself into the soil, as above described. The material of which meteors is composed is known as meteoric iron, a useless, burned metal, resembling cinder of iron, but utterly useless, except as a curiosity.

Simple Treatment for Sciatica.

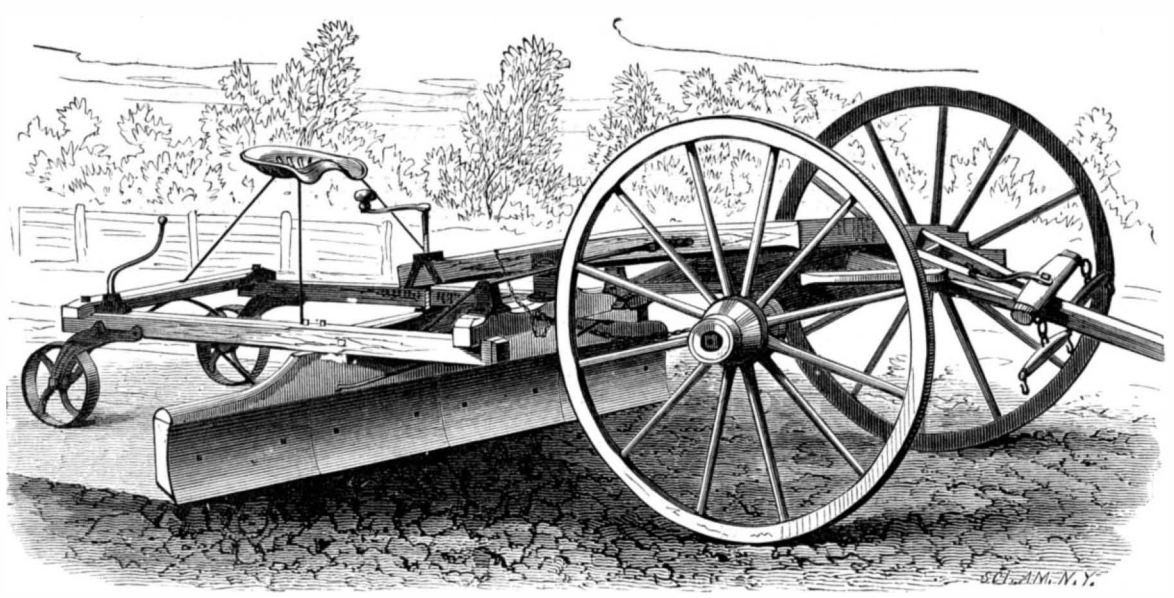
Dr. Ebrard, of Nimes, states that he has for many years treated all his cases of sciatica and neuralgic pains with an improvised electric apparatus, consisting merely of a flatiron and vinegar, two things that will be found in every house. The iron is heated until sufficiently hot to vaporize the vinegar, and is then covered with some woolen fabric, which is moistened with vinegar, and the apparatus is applied at once to the painful spot. The application may be repeated two or three times a day. As a rule, the pain disappears in 24 hours, and recovery ensues at once.—*Jour. de Méd., etc., de Bruxelles.*

IMPROVED ROAD PLANE.

We give herewith an engraving of a simple and easily operated implement for planing, leveling, and smoothing roadways, boulevards, etc.; removing the earth or gravel from the high to the low places, filling them, and carrying the remaining earth toward the center of the road.

It consists of a curved blade suspended diagonally from the under side of a rectangular frame supported at the rear on wheels, and at the front pivoted to a coupler or reach, one end of which is connected with the planer frame by an elevating and depressing screw, while the opposite end, when the implement is in use, is supported on the axle of the front wheels of an ordinary wagon. In connection with the right hand hind wheel there is a screw, by which the ends of the planer blade may be raised or lowered, so that if it is desired it may scrape hard in the drain at the road or track side, passing the dirt under the blade, and spreading it before it gets to the opposite end of the blade.

This implement was recently patented by J. P. Lafetra, of Shrewsbury, N. J.



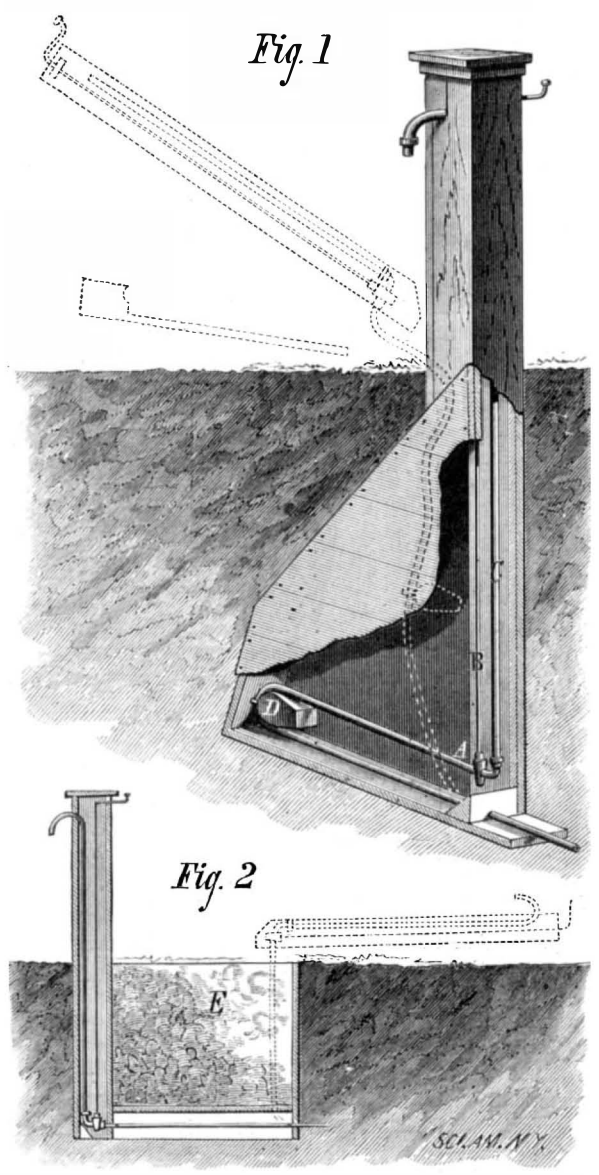
LAFETRA'S ROAD PLANE.

IMPROVED HYDRANT.

The great difficulty in removing, replacing, repairing, or changing the ground faucets or valves of hydrants as ordinarily constructed, has led to the improvement which is shown in our engraving, and which was recently patented by Messrs. Benson & Rose, of Detroit, Mich.

The invention consists essentially in a box or casing of novel form, and in an arrangement of the water pipes, which permits of the examination or repair of the faucet or pipe.

The box or casing (Fig. 1), the upper portion of which may be of any of the usual forms, is enlarged below the ground and made in approximately triangular form, one side being vertical and a continuation of the upper portion. This peculiar form provides for the accomplishment of the main object of the invention, which is the arrangement of the water pipe, C, so that it may be raised to permit of the examination and repair of the faucet, A. The water pipe, C, is carried along the lower horizontal portion of the casing to the angle, where it is bent double and carried back nearly to the vertical side, where it is bent at a right angle and carried vertically to the top of the casing, where it terminates in the usual bibb or nozzle.



BENSON & ROSE'S HYDRANT.

At the point where the pipe is bent double it is provided with a semi-elliptical block, D, attached to it in any suitable way for preventing the pipe from being broken or flattened when it is bent. The faucet, A, is provided with a valve rod, B, which extends to the top of the casing and terminates in a crank or handle.

The top as well as a portion of the side of the upper portion of the casing is made removable, so that when access to the faucet or valve, D, is desired, the cover and side of the box are removed, and the carrier piece, by which the pipes and valve rod are supported, is raised vertically until its lower end clears the enlarged portion of the casing. It is then inclined, as indicated in dotted lines. The pipe is sufficiently flexible to admit of straightening it out. The valve, A, may then be inspected or repaired, and the whole may afterward be readily replaced.

Fig. 2 shows a modification of the device already described. The box, instead of being triangular, is square and the pipe is straight. The pipe is raised up in the manner indicated in the engraving, when it is desired to examine the valve. To prevent freezing, the box is filled with straw, tan bark, or earth. This is readily removed with a small hoe when occasion requires.

Further information concerning this invention may be obtained from Messrs. Benson & Rose, No. 539 Mallett St., Detroit, Mich.

RECENT AMERICAN PATENTS.

Mr. Jacob J. Boyer, of Hebron, Neb., has patented an improved bag fastener, which consists of a metal chain having a split ring for connecting the chain to the bag, and provided with a number of rings and with a hook for engaging the rings when the bag is fastened.

Messrs. L. B. Schaefer and H. Hennings, of Baltimore, Md., have patented an improved scholar's companion, which consists in an arrangement of a receptacle for containing various small articles, and two crossed straps for securing the books, an arm strap being provided for convenience in carrying.

An improved stand for ice pitchers has been patented by Mr. Thomas Leach, of Taunton, Mass. It consists mainly in an annular seat adapted to receive the base of any kind of pitcher. This seat is hinged to a segmental support which admits of tilting the pitcher.

Mr. John Askwith, of Chicago, Ill., has patented an improvement in cans, which consists in feet formed of a cup and stem, the object being to prevent any oil or other liquid that may be upon the bottom of the can from spreading to the lower end of the feet.

An improved switch board, which is so arranged that a message may be transmitted on any two wires simultaneously, and which admits of working either wire separately and independently, has been patented by Messrs. W. E. & J. W. Busby, of Shamong, N. J.

An improved boot strap, which consists of a metallic strap or ear provided with a loop for the finger, and a plate with projecting points which pass through the boot leg and are bent down to secure the strap to the boot, has been patented by Mr. William Smith, of Eaton Rapids, Mich.

A neat and easily arranged clothes horse that can be fixed to the wall of a room and adjusted to receive a larger or smaller quantity of clothing, has been patented by Mr. Thomas W. Green, of Philadelphia, Pa.

An improvement in bakers' ovens has been patented by Mr. George Brake, of Lansing, Mich. The sides, ends, and roof of the oven are of brick, and the bottom, which is of stone or some refractory composition, is supported on central arches over an end fireplace and on projections or recesses at the ends and sides.

Mr. Frederic Jensen, of Seattle, Washington Ter., has devised an improved convertible chair, which may be used as a bed. It is so contrived that the supports for the bed are out of sight when the device is used as a chair.

An improved hold-back for vehicles, patented by Mr. Hermon F. Morse, of East Foxborough, Mass., consists of a flat steel spring, fixed to the shaft by the shank of the breeching hook with its free end bearing against the open end of the hook.

An improved attachment for organs, pianos, melodeons, and other keyboard instruments, by which any one, though wholly unacquainted with music, can play music of any kind, has been patented by Mr. E. F. O'Neill, of Storm Lake, Iowa.

Mr. James K. P. Pine, of Troy, N. Y., has patented an improved check rein guide, which supports the check rein so as to prevent the hurting of the horse's head at the front or rear, and it admits of the use of an overhead check rein.

An improved apparatus for steaming printed fabrics has been patented by Mr. James Smith, of Thornliebank, North Britain. For the fixation of the colors on printed goods, such as calico, it is necessary to subject them to the action of steam. The invention referred to pertains to an improved apparatus for carrying such fabrics into and through the steam-filled chamber.

A chocolate breakfast powder, consisting of sugar coated with chocolate, and in granulated form, has been patented by Mr. J. G. Finke, of New York city.

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SOME INTERESTING ECHINODERMATA.

Not the least remarkable among the animals belonging to the class of Echinodermata, or urchin skinned animals (so termed on account of the numerous spines and anchors protruding from their skin), are the holothuridæ. A property peculiar to the majority of holothuridæ consists in the capability of ejecting their entire entrails on being excited or scared.

On account of their extreme excitability they are little adapted for collection and preparation for museums. Dried they look like a piece of old leather, while, if placed in alcohol, they cannot be distinguished from an old bologna sausage. Says Brehm: "The only manner in which I could succeed in retaining them in a nearly natural attitude, with the feelers spread, was to replace the salt water in which they were kept, gradually by sweet water. Even if the tentacles had been kept withdrawn for days, they would, in that case, stretch them out gradually and die. A colored picture, painted from nature, will be of better service for illustrating the form and structure of the animal than an individual preserved in any manner."

Some species of this family are much esteemed by the Chinese and the inhabitants of the Malay Archipelago as an article of food. Trepang, as it is called, is of considerable importance as an article of trade. The Chinese ascribe to it aphrodisiac properties; many Europeans eat it on account of its ready digestibility. Like the edible birds' nests they have no peculiar taste, being merely formed of animal protoplasm.

The holothuridæ just mentioned are supplied with special breathing organs — a sort of water lung, consisting of a numerously branched tube traversing nearly the entire length of the animal, into which also end the alimentary channel and the digestive sac. The animals are enabled to inhale and exhale water by means of this lung, some four or five rapid inhalations being followed by a vehement expulsion of the water inhaled. The lungs, as well as all other vascular organs, may be ejected, but they are reproduced in eight to twelve days.

The holothuridæ which are without lungs also lack the sucking disks, and form a distinct group. Their organs of respiration consist merely of a ring encircling the œsophagus, to which are attached a row of blubbers and the tentacles. In this respect they resemble the young of other families of holothuridæ. Even when grown up, the lungless holothuridæ use, like the larvæ of those possessing lungs, the tentacles as organs of motion.

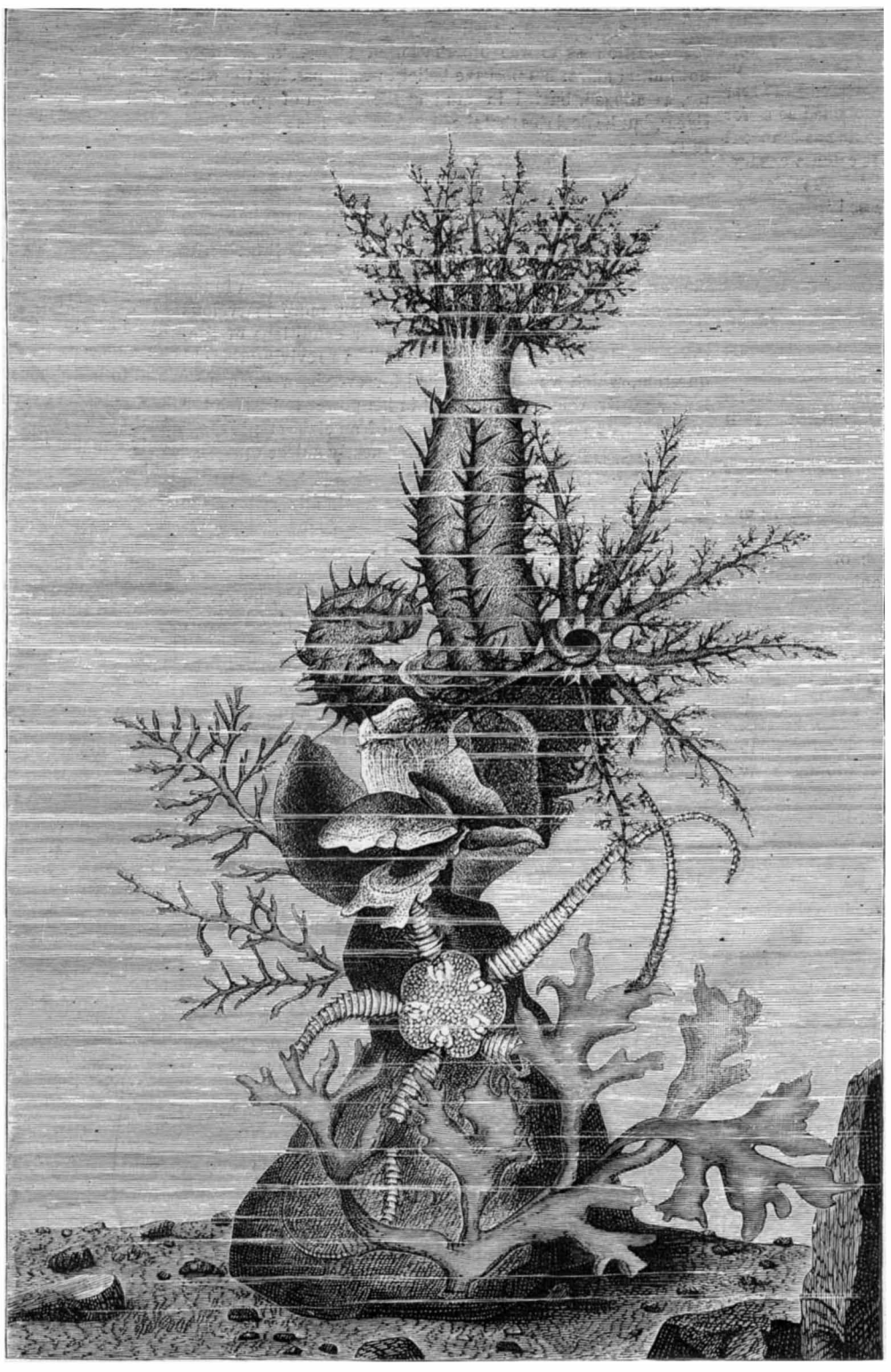
The most important species of this class of animals is the anchored holothuriæ or synaptæ, which is illustrated by the accompanying engraving, which represents two of these curious animals as drawn from nature at the Naples aquarium.

The entire surface of the skin is provided with characteristic two-armed calcareous anchors, the shafts of which pass through a perforated plate and end in small circular knobs by which they are held in position. These anchors are large enough to be noticed with the naked eye. Of the two species illustrated, one, *Synapta inhærens*, shown in the engraving in two thirds of its natural size, is found along the northwestern coast of France. The other, *S. Beselli*, is an inhabitant of the southern seas; in appearance it is similar to the *S. inhærens*, and we have therefore only represented the anchors, as they are especially well developed in the latter species. Another European species, so far found exclusively in the neighborhood of Trieste, has become celebrated on account of being the seat of a parasitic snail, the nature of which was determined chiefly by Johannes Müller.

Besides the capability of expectorating and reproducing their entrails, the synaptæ possess another means of mutilating themselves, and this is so habitually done that an unmutilated animal is rarely met with. Baur says with respect thereto: "The mutilation as practiced by synaptæ consists in the separation of entire sections of the body by means of violent muscular contractions. The sections separated move about for some time, but die ultimately. They are unable to reproduce the forepart with mouth and tentacles. Every headpiece, however, may reproduce the sections separated, but this is not generally the case until almost the entire body, up to the calcareous ring surrounding the œsophagus, has disappeared. The capability of reproduction is destroyed when this ring is severed from the mouth by a small incision. It seems, however, as if the calcareous ring only served as a protection to a band of very fine nervous threads which are cut by the same operation."

Some synaptæ of southern seas become so large as to be taken for sea snakes. Semper relates having caught a *Synapta Besseli* off Bohol Island measuring over six feet in length. Their motions are very slow. Curled up they rest between stones and in the sand, and move, when disturbed, slowly forward by progressive contractions of the body aided by the tentacles. The anchors are certainly never used for locomotion. If they have been hooked into a body they invariably break off as soon as the animal moves. Although the anchors are movable they have no connection whatever with the nervous or muscular system, and consequently cannot be controlled by the animal.

The synaptæ climb only when roughly touched; ordinarily they pass between stones and plants without adhering to them, and in a new species, *S. glabra* (three feet long), recently discovered, these organs were so deeply embedded into the skin that they were at first considered anchorless.



INTERESTING ECHINODERMATA.

We are at present pretty well informed as regards the different stages of development of holothuridæ.

The microscopically small larvæ may be easily caught with a fine net on the surface of the sea during quiet weather. The later stages may be procured with a dragnet.

The larvæ present an appearance decidedly different from that of the adult animal, being built very symmetrically, and having the form of a flatboat, the fore and aft ends of which are bent over to form a partial deck with curved edges, lined with very fine hair, by the aid of which the minute animal is enabled to swim, conical end forward. The most important inner organ is the digestive canal. We notice in the larvæ a few bags, which ultimately form the main body.

From another rudimentary organ the vascular system is developed. There are two circular masses of lime near the anus, which disappear in the adult, but which are of importance in determining the stage of development attained by allied species. The larva gradually develops into the chrysalis, which has the shape of a barrel. It is flattened at the top, round at the bottom, and encircled by four rings. Within this inclosure the synapta acquires its ultimate form, the tentacles become visible, the vesicles attached to the calcareous ring are being formed, the longitudinal muscles are developed. Finally the cover of the barrel opens, and the tentacles at once protrude and become more elongated. Gradually the walls of the barrel unite with the skin proper of the synapta, forming its exterior covering. They are now about 0·05 inch long, and the calcareous circular bodies are still attached to them, but are ultimately lost.

Habits of Wild Animals at Night.

A reporter of the New York *Sun* had an opportunity recently of visiting a menagerie at night, and he thus tells what he saw and what the animals did on being disturbed of their night's rest. He commences by describing the monkeys, which, he says, were clustered together on the floor in the corners of the cage. The attendant, who showed the reporter about in the dim light of a couple of gas burners, scratched the cage with his cane, and instantly a dozen whitish spots appeared on the surfaces of each of the clusters. These were the faces of the monkeys. They were held perfectly still for a short time, but when another gas jet was lighted nearer the cage several monkeys broke away from their companions to leap from perch to perch and squeal like bats. Dr. Starr, the attendant, said that the monkeys sometimes roosted like chickens on their perches, but such a peculiarity was not observed in any of the cages. Mr. McClean, a very trustworthy keeper, says they often indulge their propensity for fun by pulling each other's tails and pinching each other at dead of night, when the whole cage will set up a chatter. Monkeys never snore, but there is always heard a sniffling sound, the premonitory symptom of consumption, of which they generally die on account of the coldness and changes of a northern climate. In separating into different clusters to sleep each species seeks to keep by itself as much as possible.

Dr. Starr said the pelican usually squatted on the floor of his cage like a duck in its coop, but it was found roosting on the edge of a water tank in its cage. Its big webbed toes are furnished with long, sharp, curving claws, and clutched the metal covered edge with a firm hold. Its beak, nearly a foot in length, rested along its back. When a keeper's hand was thrust warily between the bars, the long beak, as it seemed, with a single motion, moved viciously from its back and struck a bar of the cage against which the hand had rested. After that it stood up on guard, showing its big brown legs, and awkwardly brandishing its beak. The snakes lay motionless, most of them being in a cluster. The ostrich lifted itself from a squatting position on the floor of its cage when the visitors approached, looked out of one eye inquiringly, and tetered its long neck up and down, as if it were balancing its body with it on its two ungainly legs. The kangaroo lay a long time without moving. At last, aroused by the conversation of its midnight guests, it suddenly lifted its head, and with its tail gave a thump or two on the side of its cage. Its tail is very long, thick, and powerful, and when it is attacked in close quarters it is said to whirl about and use it like a club. After a short time it sat upon its haunches, and began to yawn and scratch its sides with its short forelegs, like a monkey. The front of the mandrill baboon's cage was closed with a horizontal shutter. When this was being removed the creature's paw missed a keeper's hand only by half an inch. It stood on all-fours, about three feet high, and glared through the bars with its gray, sunken eyes, throwing a queer expression of cool contempt into its blue cheeks and bright carmine nose. It would occasionally thrust out its chin, decked with a short, sandy beard; but it is said to be very treacherous, and when it is angry it has been known to put forth strength equal to that of two men. It took a chew of what a keeper said was tobacco, rolled it about in its mouth, and appeared to enjoy it. Dr. Starr said that it could smoke, but that it was not allowed to have matches. The capibara, a kind of hairless

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South American hog, scrambled up when it heard a noise, and ran to its trough, over which it stood looking expectantly at those who had disturbed it. The little sun bear was rolled up in a black ball in a corner of its cage, while the first sight of the grizzly in another apartment of the same cage showed it swaying noiselessly to and fro. The striped hyena was roaming about in its cage. A ridge of coarse hair arose along its back when it was disturbed, and it retired to the rear of the cage to glare at its visitors. It kept up a low but unceasing growl. It retains the wild instincts of its ancestors, and the keepers say that this low growl can be heard nearly all night. It howls a prediction of a storm several hours before the storm comes.

Savage hisses were heard from two black leopards before the visitors arrived at their cage. When a neighboring gas jet was lighted their glistening teeth and red gums came into view. Their upper lips were drawn back as they crouched on the floor, and their short ears were laid back until it seemed as if there was no room for any brains in their serpent like skulls. They are the fiercest of all the beasts in the menagerie, and so wild that when they are changed to a new cage they will not eat for several days. A large spotted hyena was found growling in the dark, and twisting uneasily on its back with his clumsy feet in the air. He weighs 250 lb. He immediately got up, and retiring to the back of the cage, glared menacingly. A wildcat sprang to the rear of its cage when it was approached, and crouched as if for a spring. A moment afterward it sat up looking as innocent and unconcerned as a house cat after it has eaten a canary. It killed three of its brothers last summer. A jaguar glanced carelessly at the midnight party as they passed its cage, but otherwise affected to disregard them. Two lions, born in Central Park two years and a half ago, lifted their nozzles from their front paws, stretched out in front of them, and showed their fine large fronts, while they blinked lazily at a newly lighted gas jet. Showmen like lions, on the whole, much better than tigers, because they are not so treacherous; but they say that a bad lion is worse than a tiger. Before approaching within reach of a lion, a keeper always tries its disposition by coaxing words and by offers to pet it. If it holds down its head to be scratched, it is considered to be in a safe mood to handle. The rhinoceros sleeps with a hoarse snore, and resembles a huge over-fat hog as its body spreads out over the bottom of the cage. The one in Barnum's menagerie is said to weigh 7,900 lb. All of the framework of the wagon on which its cage rests is made of steel. It is said that it would be the most dangerous animal in the menagerie if it should escape in an angry mood. Though usually very sluggish, it is terribly quick in action when angry, and there is practically no limit to its strength.

The four or five baby elephants stood in a row, fastidiously selecting choice spears of hay with their restless trunks, while Emperor and his huge mates lay sprawled out on their sides, their upper sides being rounded up into formidable mounds of flesh. The effect of the light was to make several of them lurch backward and forward sideways, and finally sit up on their haunches in their clumsy, broken-jointed fashion. The sea lion sleeps on its platform and not in the water. The giraffe usually holds its long neck nearly erect, with its legs doubled under him like a horse.

Keepers in a menagerie divide their charges into six classes —hay animals, cat animals, monkeys, elephants, birds, and fishes. If a keeper of the cat animals is killed, or if he leaves his situation, the management look about for an experienced man to take his place. If they cannot find any, they promote one of the oldest and trustiest hay animal keepers to the vacant position. The cat animals comprise everything of a naturally savage nature, including the lions. The hay animals include deer, giraffes, and the like. In the elephant class are included rhinoceroses and hippopotami. It requires a particularly steady and trustworthy man to care for the "cats," which can never be handled or changed from cage to cage without precautions, no matter how tame they may seem to be.

NATURAL HISTORY NOTES.

The Peripatus.—In Mr. Moseley's recent work, "Notes by a Naturalist on the Challenger Expedition," the author gives the following description of the *Peripatus capensis* found at the Cape of Good Hope. This curious creature is believed to be a nearly related representative of the ancestor of all air-breathing arthropoda—*i. e.*, of all insects, spiders, and myriapods. Before Mr. Moseley collected, examined, and dissected specimens at the Cape, nothing was known of its development. The animal has the appearance of a black caterpillar, the largest specimens being more than three inches in length, but the majority smaller. A pair of simple horn-like antennæ project from the head, which is provided with a single pair of small, simple eyes. Beneath the head is the mouth, provided with tumid lips, and within with a double pair of horny jaws. The animal has seventeen pairs of short conical feet, provided each with a pair of hooked claws. The skin is soft and flexible, and not provided with any chitinous rings. The animal breathes air by means of tracheal tubes, like those of insects. The sexes are distinct; the males are much smaller and fewer in number than the females. The animal is provided with large glands, which secrete a clear viscid fluid, that it has the power of ejecting from two papillæ, placed one on either side of the mouth. When touched or irritated the animal discharges this fluid with great force and rapidity, and in fine thread-like jets. These jets form a sort of network in front of the animal, looking like a spider's web with dew on it. The viscid substance (which is not irritant when placed on the tongue) is exceedingly tenacious, like bird-lime, and when the author put some on a slip of glass some flies approaching it were at once caught and held fast. This slime is used not only as a means of offense, but to catch insects on which the animal feeds. The animals live in or under dead wood, are nocturnal in their habits, and their gait is exactly like that of a caterpillar.

That the *Peripatus* is a very ancient form is proved by its wide and very peculiar distribution. Species of the genus occur at the Cape of Good Hope, in Australia, in New Zealand, in Chili, in the Isthmus of Panama, and in West Indies. If its horny jaws were only larger, Mr. Moseley thinks they would no doubt be found fossil in strata as old as the old red sandstone at least.

The Hibernation of Swallows.—It was an old and popular superstition that swallows, late in autumn, hide themselves in holes in the earth, in marshes, or under water; and it also used to be asserted that great lumps or numbers of the birds were frequently fished up, fixed to one another by their claws and beaks, and that these when laid in a warm place quickly revived, although they before seemed dead. Curiously enough, Dr. Elliott Coues, in his work on "The Birds of the Colorado Valley," published by the government, revives this old question as to the hibernation of swallows. He does not indeed affirm his positive belief in their passing the winter, as alleged, buried in mud at the bottom of ponds and rivers, but he declares that the occurrence of this phenomenon rests on as good evidence as many other things which are accepted as facts in natural history, and that his mind, at any rate, is open to conviction. He says: "I see no reason why a swallow should not stay a while in the mud in a state of suspended animation, or greatly lowered degree of vital activity. The thing is physically and physiologically feasible, and is in strict analogy with observed phenomena in the cases of many other animals; and it is not more marvelous than catalepsy, trance, and several other conditions of life, the rationale of which is still obscure." In reviving this old question, which we supposed had for ever been set at rest long ago, Dr. Coues has done all in his power to furnish the means for its solution, in the shape of an elaborate bibliography of the subject, extending over nearly a dozen pages.

The Germination of Mushroom Spores.—It has been generally supposed, and in fact it is asserted in all works on the subject, that the spores of the common edible mushroom cannot be made to germinate until they have passed through the body of a horse or some other graminivorous animal. Mr. W. G. Smith, an eminent authority, denies this, however. He says, in the current number of the *Gardener's Chronicle*, that "it is a mistake to suppose that the mushroom spores will not germinate until they have passed through the stomach of a graminivorous animal, for I have several times seen the spores germinating upon clean glass. I first noticed the fact by accident, after I had left a number of freshly fallen spores under the microscope all night. On looking at the slide in the morning nearly every spore had germinated. But then the spores were perfectly fresh and alive. My observations lead me to think that spores very soon die in unsuitable dry air or when they fall upon any unsuitable matrix. Many other fungus spores will germinate upon glass, it being always remembered that for this purpose the spores must be perfectly fresh from the hymenium of the parent fungus. Fungus spores will grow freely upon damp blotting paper; they cannot be seen when upon this material, but they can be easily transferred (by mere contact) to a damp glass slide. Several dung-borne agarics (as they are often termed), including the mushroom, are not uncommon on the sea sands, in positions where graminivorous animals rarely disport themselves."

A Rival of the Shellac-producing Insect.—The *Colonies and India* states that an American explorer has recently discovered in the little known district of Yucatan, bordering on British Honduras, a valuable insect, possessing properties which ought to make it a rival of the cochineal and shellac-producing insects. This is the *Neen*, or *Niin*, a species of *Coccus*, which feeds on the mango tree and similar plants, and exists in enormous quantities in Central America. It is of considerable size, of a yellowish brown color, and emits a peculiar oily odor, containing as it does a large quantity of fatty oil, or rather grease. This grease is used by the natives for various purposes, being highly prized as a medicinal oil for external application, and it is also employed for mixing paints. It can be made to change its condition very considerably by different processes. When exposed to great heat the lighter oils evaporate, leaving a tough, flexible mass, resembling half softened wax, but unaffected by heat or cold, and which may be used as a lacquer or varnish. When burnt this material produces a thick semi-fluid mass, somewhat resembling a solution of India rubber, which after a few days becomes hard and solid. As a cement this substance will be invaluable, and it might also be used for waterproofing purposes.

Electrical Eels.—According to the *Popular Science Review*, M. Fritsch, after an examination of a fresh specimen of *Gymnotus electricus*, concludes that this fish is allied to the siluroids rather than to the eels, and hence the term "electrical eel," by which it has hitherto been popularly known, is a misnomer. He founds this opinion especially upon the structure of the brain, which has the olfactory tubercles small and the cerebellum very large, as in the siluroids; whereas in the true eels these parts present exactly the opposite character. Further, in the *Gymnotus*, as in the siluroids, the maxillaries are rudimentary, and the margin of the upper jaw is formed by the intermaxillaries; in the murænoids, on the contrary, the maxillaries form part of this margin and bear teeth. The structure of the opercula constitutes another agreement with the siluroids. From consideration of these and other characters M. Fritsch is inclined to place the gymnoti close to the malapternini, which also include an electrical species.

The Ivory Nut Palm.—A writer in a recent number of *Science Gossip* states that in 1843 Mr. William Purdie was dispatched to New Granada to collect plants for the Royal Gardens, Kew. He was specially instructed to find a few special plants, one of which was the ivory nut palm. In his account of this Mr. Purdie says: "In a journey of 600 miles, from Santa Martha to Ocana, in New Granada, at the village of Semana, seventeen leagues from hence, and near the great river Magdalena, I entered the mountains, and saw for the first time the ivory nut palm (*Phytelephas macrocarpa*), called *Tagua* by the natives. The habit of this palm is to have little or no stem, what there is is decumbent; it is not a robust tree. Old plants have from fifteen to twenty primate leaves, which when fully grown measure nearly twenty feet in length, of a delicate green color, very graceful, and similar to those of the date palm. The male and female flowers are borne on separate plants. The male flowers are produced generally in six clusters from the bases of the leaves and on short footstalks. The clusters are compact and form a nearly globose head, which, on account of the style-like projections resembling the rigid hair of a negro, is not inaptly called *Cabeza del negro* (negro's head). These heads lie close to the ground, each cluster containing four or five seeds. The seed contains at first a clear insipid liquid, which afterward becomes milky and sweet, and ultimately hardens and becomes the "vegetable ivory" of commerce. Each of these nuts is about the size of a green walnut, and is covered with a yellow, sweet, oily pulp, which is collected and sold under the name of *Pepo del Tagua*. A spoonful of the latter with a little sugar and water makes the celebrated *Chiche de Tagua*, said to be the most delicious beverage of the country.

The stem of the male plant is larger and more erect than that of the female, and the singularity of its inflorescence is only equaled by its beauty. The fragrance is most powerful and delicious, exceeding that of any other plant, and so diffusive that the air for many yards becomes alive with myriads of insects. Mr. Purdie states that he had to carry some of these blossoms twelve miles, and though he killed a number of the annoying insects that followed him, yet the next day a great many still hovered about the flowers, having come all the way from the woods where the latter grew.

Propagation of Rock Fish.—(*Roccus lineatus.*)

A notable achievement in fish culture is reported by the Baltimore *Sun*, namely, the successful hatching of several hundred rock fish or striped bass, as they are more commonly known in this market. The credit is due to Major T. B. Ferguson, of the United States Fish Commission, who thinks it one of the most important gains of fish culture, since the rock fish is good at all seasons and is one of our leading sources of sea food. Hitherto the spawning time of this fish has not been known. The young rock fish now at Druid Hill Park hatching house are the produce of three ripe rock fish taken May 6th at Dr. Capehart's fishing shore, "Avoca," on Albemarle Sound, N. C., near the mouth of the Roanoke river. From these three fish nearly two bushels of eggs, estimated at three millions, were taken and impregnated, but the proper preparation had not been made for their treatment, and the result was not as prolific as could have been desired. Indeed, although the fish commissioners have been long bent on finding out the habits of the striped bass, the capture of these ripe fish was a surprise. They were taken and spawned by Wm. Hamlen, of Baltimore, who resides on Federal Hill, and has been in the employment of the Maryland Fish Commission for several years. Mr. Hamlen was fortunate also in hatching the first smelt, under Major Ferguson, in the Raritan river, and last season he was successful in securing herring eggs, from which 500,000 fish were hatched at Avoca, on Albemarle Sound, and brought to Washington and Baltimore for distribution.

The striped bass hatching was in connection with United States fish hatching work under the superintendence of Major Ferguson, who has thus been instrumental in achieving success first with smelt, then with herring, and now with the striped bass. The eggs of the ripe rock fish are green, opaque, and smaller than the eggs of shad. After impregnation they become fifty per cent larger than shad eggs, and their specific gravity is lighter. They are almost perfectly transparent, and have only a small speck. They have a large umbilical sac, a quarter of an inch long, and almost invisible. In water at the temperature of which shad eggs will hatch in four or five days, rock fish eggs will hatch in thirty-six or forty-eight hours.

The Obelisk.

Mr. Dixon has partially gained his suit against the underwriters for the salvage of the Cleopatra and the obelisk when cast away off the Spanish coast, and *Iron* says the result gives general satisfaction. It is also satisfactory to find that the "Needle" itself has been successfully coated with an indurating solution which it is hoped will protect it for many years from the action of the sulphurous acid that the sea coal fires of the metropolis disgorge into the atmosphere to the detriment of most descriptions of stone. The monolith had been greatly injured on the surface from exposure to atmospheric influence in Egypt, especially since it was

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thrown down; and it also, owing to the disorganized condition of its exterior, received further injury during its transit to this country. The effect of the silicious wash, we are told, has surpassed expectation, and is only to be compared to the restoration of an old painting. The obelisk first received a thorough cleaning, it was then coated with the solution, and now appears as if just chiseled from the rock, showing its original colors, the quartz and feldspar glittering in the sunlight. The intaglio also comes out much more distinctly than before.

The Metric System.

During the last Congress much evidence was collected with reference to the compulsory adoption of the metric system in this country. Among the papers was the following able report by the Quartermaster General:

"In reply to the reference of the resolution of the House of Representatives, in regard to the objections which may exist to making the use of the metric system of weights and measures obligatory, first, in all government transactions, and second, in all transactions between individuals, and the length of preliminary notice desirable before such metric law goes into operation in the United States, I have the honor to say that if the law makes the use of the metric system obligatory in all government transactions it can be adopted by officers of the Quartermaster's Department as soon as notified by general orders.

"Such an order can be distributed to every military post within the space of one month from the time of its publication, and, if the telegraph be used, within one week.

"The objections thereto which at once occur to me are:

"1. It will very considerably increase the labor of computation, for, in practice, all sellers to the United States will make their deliveries in accordance with the English measures now in general use, and the officers, using the ordinary scales for weight, and the yard, foot, and inch, and bushel, gallon, quart, and pint for measures, will first ascertain the quantities and sizes in the present weights and measures, and then, by the use of tables to be distributed, will reduce them to metric quantities in their statement of their vouchers, receipts, and accounts, which will, it appears to me, be a perfectly useless labor.

"2. This reduction, involving additional calculations and transfers from one set of units to another, unfamiliar, and much less convenient, will infallibly be the source of many mistakes, to the loss of the disbursing officer of the Treasury, or of the person who sells supplies to the United States.

"3. It will be necessary, in order to make the operation of such a law really successful, to throw away all the hay scales and other platform scales whose beams are now divided according to the American standard of units of weight, and all the rules and measures divided according to the yard, foot, and inch, and all the weights, pounds, ounces, or grains, of avoirdupois, troy, and apothecaries' weight, and to purchase, distribute, and substitute new scales and new weights according to the metric system. These changes will be expensive. The trouble and labor I do not speak of, as such labor will, in case of the passage of a law, simply be the duty of all officers and employes of the United States.

"4. If the metric system is made obligatory in government transactions and not in transactions between individuals, then continual confusion and misunderstanding will be caused by the use of one standard by the government and another by the people. All packages are put up by merchants, manufacturers, and producers in accordance with the actual legal standards, pounds, ounces, grains, yards, feet, inches. The transactions of the United States, large as they are, are insignificant compared with those of private trade. Manufacturers and consumers and the people will not change their customs at the call of the officers of the United States.

"In regard to making the metric system obligatory in transactions between individuals:

"I do not believe that this is within the power of Congress. It will be looked upon by the people as an arbitrary and unjust interference with their private business and individual rights, and I do not think they will submit to it. It will inflict, if it can be enforced, a great loss upon many, especially upon manufacturers and mechanics whose shops are filled with costly tools, standard gauges, dies, and machines, all constructed upon the basis of the foot and inch.

"Every geared lathe in the United States depends upon a screw of a certain number of threads to the inch, and all the screws it produces are gauged in pitch and diameter by the inch.

"The meter is not commensurate with the inch, foot, or yard; all reductions are approximate only. The law of July 27, 1866, makes the use of the metric system permissive, legal, but not obligatory, and establishes for the reduction of meters to inches, and the reverse, the ratio of one meter to thirty-nine and thirty-seven hundredths inches, which is not absolutely correct. To alter all this machinery, to change all these machines, gauges, dies, screws, and other parts of engines, will be the work of years—will cost millions of dollars.

"The metric system is not a convenient one for common use. Its measures are not of convenient length. The yard, half the stature of a man, is of convenient length to handle, to use, to apply. It, and the goods measured by it, can be halved, quartered, subdivided into eighths, sixteenths, thirty-seconds, sixty-fourths, etc.; or it can be with equal facility divided into tenths, hundredths, thousandths. Half a meter is no dimension: half a centimeter is an unknown quantity; but half a yard, half a foot, half an inch, half a bushel, one fourth of a bushel, of a quart, of a pint, etc., are recognized. If half a liter, of a deciliter, or a quarter, eighth, or sixteenth of these quantities is provided for, then the metric decimal system is abandoned at once.

"In calculation the metric system applies admirably to money and accounts of money; but even here the government has been obliged to abandon for the convenience of the people the true, strict, decimal system, and to coin half a dollar, half an eagle, the quarter of a dollar, etc.

"In the use of weights and measures, however, there are not so great advantages in the decimal system. The unit is too large, and the numbers produced and used in the calculations of the engineers are tedious to write and are beyond the limits of ready apprehension.

"The ciphers and figures 0·00000073 convey no idea to a mind trained in the English and American system, and yet such combinations are common in French works of science and mechanics.

"The true scientific natural basis of the metric system has been abandoned. The meter was intended and enacted to be the ten millionth of the quadrant of the terrestrial meridian of Paris. In the progress of geodesy and science, it is ascertained that the standard meter bears no (exact) relation to that quadrant, and, though it is probably very nearly the ten millionth of the quadrant of the meridian in which New York lies, it is not probable that it is the ten-millionth of either of the three other quadrants of that meridian, or of any quadrant of any other meridian.

"The fact is, that the meter is quite as arbitrary and unscientific a standard as the foot, or yard. It is of less convenient length than either of them, and its compulsory adoption would derange the titles and records of every farm and of every city and village lot in the United States; would put every merchant, farmer, manufacturer, and mechanic to an unnecessary expense and trouble, and all, it seems to me, for the sake of indulging a fancy only, and a baseless fancy, of closet philosophers and mathematicians for a scientific basis of measures and weights which (as the meter is not a ten millionth of the Paris quadrant, is not what it professes to be and was enacted to be) cannot be found in the French metric system.

"1. The unit of length: The meter is 3·280890 + feet, or 39·37079 + inches.

"2. The unit of area: The are is 119·60332 + square yards.

"3. The unit of liquid measure: The liter is 0·26418635 + gallon, or 1·0567454 + quart, or 2·1134908 + pints.

"4. The unit of space: The stere is 1·308764 + cubic yard, or 35·386636 + cubic feet.

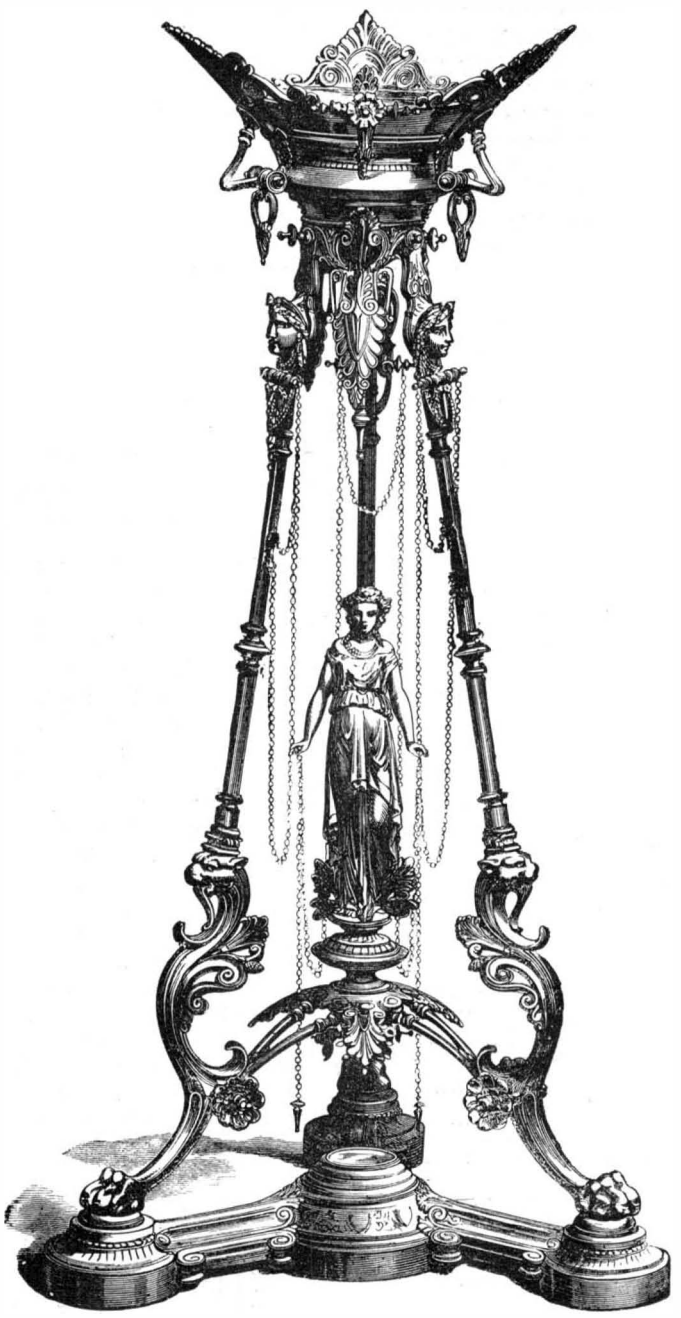
"5. The unit of weight is: The gramme = 15·43234874 + grains troy.

"6. The unit of roods is: The kilometer = 1,000 meters = 0·62138 + mile.

"7. The unit of land measure for farms and city lots is: The hectare = 2·47114 + acres.

"8. The commercial unit of weight is: The kilogramme = 1,000 grammes = 2·20462125 + pounds avoirdupois.

"What will our farmers, citizens, merchants, tradesmen, and mechanics do with these figures? And will they submit to being obliged to reduce acres, feet, inches, pounds, and ounces by multiplying or dividing by the above figures? "I think that to make the French metric system obligatory between individuals in this country will be an impolitic and arbitrary interference with the rights, interests, and habits and customs of the people."



BRONZE FLOWER STAND.

Self-Reliance.

There is no one element in a man's character that contributes more to his success in life, wisely says the *United States Economist*, than confidence or self-reliance in his own ability. A faint-hearted man is unstable, and will never excel. Faith in the endeavor to will and to execute is as important in a successful business career as is the keystone to the arch. A man possessed of a bold, daring, and resolute will may be modest in revealing his powers, but will be determined in performing what he conceives to be right. To men with this never-dying faith there is no such word as defeat, and when obstacles present themselves in their path, it only results in their putting forth a greater effort to accomplish their purpose.

Toil, trial, disaster, gloom, and danger may environ and threaten to overthrow the most cherished plans, yet over and above all hinderances a heroic soul will triumph and win fame and honor. The discouragements that would retard the irresolute only discover the weak places to the brave, and, strengthening these, they renew the conflict with increased vigor. Timidity creates cowards and never wins success. It is a strong and abiding faith in one's own ability to perform that overcomes difficulties that others thought could not be surmounted.

In all the pursuits of life we find that those who achieve honor and distinction are strong and self-reliant in their own powers, exercise faith in their own ability, and carry out plans conceived in their own brain. Morse had faith in telegraphic wires, and Field in submarine cables, and to-day, in consequence thereof, the lightning is harnessed to convey the news of the world in every part of the habitable globe within the compass of a few hours. Two young men in 1862 commenced a banking business in Wall street in a small office. They had faith in their own ability and also that of the United States to pay its great war debt. To-day they are the leading bankers in government securities on this continent, their daily sales running into the millions, and their name and credit take high rank in all the financial centers of the world. Not many years ago Edison occupied an humble position as a telegraph operator; to-day his name and fame are world-wide as associated with some of the grandest discoveries of ancient or modern times. Astor, Stewart, and Vanderbilt furnish examples in the large fortunes they created as to what well-directed energy and determination can accomplish in business pursuits, while the eventful life of the late Judge Packer is another striking illustration of the high position that can be attained by reliance and perseverance in the individual man, backed by a liberal endowment of common sense. In the ever-widening paths of commerce and the ever-increasing monetary circles there open up before the young men of the nation rare opportunities to win wealth and fortune. In agricultural, mining, industrial, and mercantile pursuits like avenues to attain distinction are presented. But fortune will not come by chance nor distinction by hazard; both must be won by strong, heroic endeavor. Backbone is vital in the achievement of lofty aims, and nerve and grit are essential requisites in the battle of life. A man, to triumph, must have faith in his enterprise and reliance in his ability.

FLOWER STAND.*

The engraving on this page represents an elegant bronze flower stand designed and manufactured by Mr. M. Semey, of Paris, France. A base like the lower portion of the stand is also used as the base for a candelabrum.

The judicious use made of the antique in this composition gives it interest.

* *The Workshop*: Willmer & Rogers News Company, agents, 31 Beekman street, New York city.

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Medical Uses of Linseed Oil.

At the last meeting of the American Dermatological Association Dr. Sherwell read a paper on "The Use of Linseed and Oil as Therapeutic Agents in Diseases of the Skin." Every dermatologist, he said, had seen the necessity of introducing fats into the system, and hitherto almost the only available hydrocarbon had been cod liver oil. This disagreed with many patients, and was also open to a number of other objections; while, in the more palatable form of the commercial emulsions now frequently employed, he did not consider it reliable. A more assimilable fat was therefore desirable, and he thought he had discovered it in the flaxseed. He had been induced to try its use by observing the beneficial effects of linseed cake upon cattle and horses, both in making their coats sleek and improving their general condition; and his experience had shown that the agent was of equal service to the human economy. He was in the habit of employing it in a threefold administration:

1. If the patient were a male and had sound teeth, the seed itself was the best form in which to take it. The man could carry about ten ounces of this in his pockets, and would probably consume a teacupful in the course of a day. The ordinary domestic linseed was small and dark in color, and contained only about 20 per cent of oil; while that from Bombay or Calcutta (which was the kind recommended) was larger, lighter in color, and contained about 30 per cent of oil.

2. In the case of women or children the ground seed, mixed with milk in the form of a porridge, was more desirable, and was unpalatable to very few persons.

3. In certain cases it could be given in the form of bread, although he did not consider this method quite so efficient as the others. The bread could be made by mixing linseed meal with flour in any proportion desired. This had been suggested to him by Dr. Piffard. (A loaf containing 60 per cent of the meal was here presented to the association, and was tasted by one or two of the members.)

When linseed was eaten, a natural emulsification was performed with the recent oil found in the stomach, and it had been established by chemists that a recent oil was much more active than one which had been long exposed to oxidation. The hulls also served to stimulate the peristaltic action of the intestines. He believed that it had specific virtues in dry and scaly diseases of the skin, such as pityriasis rubra, ichthyosis, and dry eczema, both on account of its special action upon the sebaceous secretion and its effect in improving the general condition of the patient.

Dr. Sherwell then gave in detail four cases of great obstinacy and severity, in which its curative influence was most happily shown. Two of them were cases of pityriasis rubra, one of pemphigus foliasis, and one of pemphigus vulgaris. He had also employed it with most marked benefit in four cases of ichthyosis, and had cured a large number of cases of chronic eczema with it. The seed was given internally in one of the forms above mentioned, and the oil applied externally. The lubricating effect of the latter was most admirable, and it had the advantage over most other oils of not becoming rancid when exposed to degraded epithelium. In eczema he was in the habit of wrapping the parts affected in a number of folds of linen saturated with it. He believed that flaxseed was a specific remedy for the sebaceous glands, increasing their secretions when it was diminished, and restoring it to its natural character when it had been altered by disease.

Dr. Van Harlingen stated that he had used linseed only in one case, and that was in the form of the oil internally; but he thought there was no beneficial result from it. This, he said, might possibly have been due to the fact that he used the ordinary domestic oil, and not that made from Bombay linseed.

Dr. Piffard said he had used the linseed oil internally, and he thought it was better than cod liver oil in many respects. Cod liver oil itself was fattening, while the iodine which it contained was just the reverse of this; and he thought this might explain why it was that it was impossible to fatten some persons on cod liver oil. The linseed, he believed, contained no starch, and it was, therefore, especially useful in diabetic patients with skin trouble, as well as affording an agreeable change of diet to them. The taste of this bread was not agreeable to many individuals at first; but it was, at all events, much more agreeable than cod liver oil.

Dr. White remarked that the so-called breads for diabetics invariably contained a certain amount of starch, and, therefore, if linseed was really free from starch, it was an important point to remember.

Brick Making on the Hudson.

The New York *Tribune* gives a detailed report of the brick industry on the Hudson, with the names of the principal firms engaged in the business, the capacity of the works, the output last year, the present supply, and the number of hands employed. It appears that between Tarrytown and Albany there are upward of 150 brickyards, varying in productive capacity from 20,000 to 140,000 bricks a day in the working season. Most of these are on the west bank of the river, which furnishes an inexhaustible supply of proper material. The sand is usually found at the surface, and the clay a few feet below, although the latter is frequently obtained at the surface and the sand at another point near at hand. The tempering machines and brick presses are now nearly all run by steam power; but the material is still carted by horses, and all other parts of the labor are performed by hand. The wages paid last year ranged from 60 cents to $3 a day, according to skill and ability to perform, "boss" burners getting the highest wages and boys the lower rate; the whole averaging about $1.25 a day. The leading establishments—seventy or more in number—have a daily capacity of more than 4,000,000 bricks. Various other small brick firms exist on the river, of which trustworthy data could not be obtained, and doubtless not far short of 400,000,000 bricks are made here in a single season, by about 4,000 men and boys; an average of 100,000 each. The great brick center is Haverstraw Bay, where about forty separate manufacturers are established, including the largest on the river. Haverstraw and vicinity are especially adapted for the work, and their bricks usually lead the market, although various other makers claim to produce an article equally good. In burning this immense quantity of brick it is estimated that 40,000 cords of wood have been consumed, the labor of cutting and hauling which is not easily realized. Cordts & Hutton, of this city, claimed to have burned last season the largest kiln ever burned above the Highlands; it contained 2,250,000 bricks.

The Torrey Botanical Club.

The regular monthly meeting of the Torrey Botanical Club was held in the "Herbarium Room," at Columbia College, Tuesday evening, May 13. Mr. N. S. Britton, of Staten Island, read a paper on

"THE ANNUAL GROWTH OF TREES."

Finding nothing on record as to the annual growth of trees and the number of years that must elapse before a sapling becomes a tree of ordinary dimensions, the author made numerous observations during the past winter, the results of which are here recorded. Three separate notes were taken from each individual tree examined: (1) as to its age, (2) as to its height, and (3) as to its trunk circumference. The age was determined either from actual knowledge of the time when the tree was planted, or by counting the annual rings in the case of felled trees; the latter means of determination may be a year or two in error in some cases, owing to the difficulty in counting where the rings were obscure. Heights were determined in the case of standing trees by simple geometrical methods; and in the case of felled trees by measuring with a tape line. The circumferences of the trunks were taken at a distance of about 3 feet above the surface of the soil. The notes were then tabulated, and those for each species averaged.

Assuming the section of a trunk to be a circle, the average circumferences were reduced to corresponding diameters. Dividing the average height by the age, the average vertical growth per annum was obtained. Applying the same method to ascertain the diameter, the quotient gives the average annual increase in trunk thickness at its base, and one half of this is the annual thickness of the rings for that species. The following table gives a summary of the results:

Trees.	Average age.	Average increase in diameter.	Average increase in ring thickness.	Average increase in height.	Number of trees on which average was taken.
	Years.				
Abies excelsa	32·6	0·61″	0·30″	1·73′	3
" balsamea	30	0·38″	0·19″	1·56′	8
Pinus strobus	27	0·51″	0·25″	1·52′	1
" rigida	32·6	0·31″	0·15″	1·17′	5
" mitis	38	0·45″	0·23″	1·18′	2
Thuja occidentalis	28	0·32″	0·16″	1·15′	3
Juniperus Virginiana	59·7	0·21″	0·10″	0·58′	12
Salix alba	32	1·06″	0·53″	1·62	3
Liriodendron	38	0·45″	0·22″	1·57′	1
Juglans nigra	26	0·41″	0·20″	1·55′	2
Quercus alba	4 8	0·35″	0·18″	0·88′	6
Acer rubrum	28·4	0·45″	0·22″	1·51′	5
Carya tomentosa	70·4	0·20″	0·10″	0·95′	5
Betula alba	34	0·18″	0·09″	1·32′	3
Fagus ferruginea	44 8	0·36″	0·18″	0·78′	5
Ulmus Americana	38	0·52″	0·26″	1·31′	2
Castanea vesca	52·3	0·51″	0·25″	0·96′	7
Sassafras	27·1	0·23″	0·12″	0·96′	8
Catalpa	32	0·55″	0·28″	1·39′	5
Ailanthus	31	0·59″	0·29″	1·46′	11
Apple	23	0·65″	0·32″	1·23′	6
Cherry	29	0·54″	0·27″	1·40′	7

The notes were all taken near New Dorp, Staten Island, over an area of, say, three square miles, so that differences due to soil and rainfall must be small, and need not be taken into consideration. The average rates of growth given in this table do not of course apply to the trees at every period of their existence, since all trees grow much more rapidly in a vertical direction when young; the annual increase in diameter is more constant, but there is a slight decrease in ring thickness as they grow older, especially noticeable in old trees, and where much crowding has taken place.

In the discussion which followed attention was called to the fact that although the chestnut is usually considered a rapid grower, yet according to Mr. Britton's table it was surpassed in this respect by most other trees. In explanation of this, Mr. Wright, of Staten Island, remarked that according to his own observations the chestnut was of slower growth near the sea coast than inland.

A large number of plants, both wild and cultivated, were as usual exhibited by different members, and among them a magnificent clump of *Helonias dioica*, which was brought in by the Vice-President, Mr. Addison Brown. Mr. Wright exhibited a very interesting sprout of the peach tree in which the flowers were perfectly white and smaller than those of the normal form. Mr. Wright stated that the fruit borne by the tree was also white. Prof. A. Wood exhibited a specimen of the long lost but recently rediscovered *Shortia galactifolia*. Mr. Leggett exhibited a proliferous specimen of *Hepatica triloba*, in which the flowering stalks arose from the bracts at the summit of the main stem.

The Largest Orchard in the World.

The *Rural Home* is inclined to think the very profitable orchard owned and cultivated by Mr. Robert McKinstry, of Hudson, N. Y., is the largest in the world. If there is a larger we should be happy to hear of it.

The orchard is situated on the east bank of the Hudson river, on high, rolling table land, and contains more than 24,000 apple trees, 1,700 pears, 4,000 cherries, 500 peaches, 200 plums, 200 crabs, 1,500 vines, 6,000 currants, and 200 chestnuts. The varieties grown are: Rhode Island greenings, 7,000; Baldwins, 6,000; King of Tompkins County, 4,000; Astrachans, 800; Northern Spy, 500; Wagener, 500; Gravenstein, 400; Cranberry Pippins, 200; Ben Davis, 200; Dutchess of Oldenburg, 200; with Jonathans, Hubbardstons, Cayugas, Vanderveers, Pearmains, Peck's Pleasants, 20 ounce Pippins, Russets, and others in less number.

The pears are Bartlett, B. d'Anjou, Sheldon, Seckel, and Lawrence chiefly. Of cherries there are twenty-eight varieties. The orchard is intersected by roads over six miles in length for the passage of wagons, and is bounded by a continuous row of apple trees set ten feet apart for four miles and a half. The apple crop of last year was 30,000 barrels. Twenty-four men and fourteen horses are employed hauling out the crop or in plowing.

The success of this orchard has not been achieved, nor is it maintained, without the closest supervision and most industrious work. The oldest trees are about twenty years old. The soil is dry, rolling gravel, with some limestone; the trees are planted twenty feet apart, and do not by any means seem to be crowded. The ground is plowed several times in the year and kept fallow; except when thought advisable it is seeded to clover. Suckers and sprouts are removed as soon as seen; the borers are watched and followed with vigor. Wires are used to reach them in their burrows, and the damaged bark is removed with chisels.

Peter B. Laweon.

Peter B. Laweon, chief engineer and superintendent of the West Point foundry, died May 14, at Cold Spring, on the Hudson. He was born at Low Point, Dutchess county, in 1810, and, having but few advantages of early education, was apprenticed to the West Point Foundry Association, then located in this city. At the age of twenty-one he was appointed by Mr. William Kemble, the proprietor, to the position of foreman of the machine shop, and the wisdom of the selection was verified by fifty-three years of active service, not only under his first patron, but the succeeding administrations of Mr. Gouverneur Kemble, Captain Robert J. Parrott, and the present firm of Paulding, Kemble & Co. As an inventor his patents have the merit of universal adaptation. To use his own expression, "I have never invented anything until the necessity arrived." His "slotter" for heavy iron work arose from the continual breakage of the best machinery in the building of the Collins line of steamships, and it is now in use all over the world. In steam enginery he was also eminently successful, he being the constructor of the engines of the United States steam frigate Missouri (burned at Gibraltar), the United States frigate Merrimac (afterward the terrible ram of Hampton Roads), the pumping engines at the Brooklyn Navy Yard, and many others. He was the first to discover that the windage of a rifled cannon ball could be annulled by a band of soft metal on the projectile, to be expanded into and cut by the rifling of the rim by the same explosion that propelled the missile. This patent expanded into the well known shot of his friend Captain Robert J. Parrott, used with such terrible effect during the late war. He was fine in personal appearance, possessed of great executive ability, and kind and genial in his disposition.—*New York Herald.*

Independent Silk Weavers.

The *Times'* report of the industrial condition and prospect of Paterson, N. J. (now more favorable than the city has ever known before) states that the greatest expansion has been in the silk industry; new mills are going up all the time, and during the darkest days of the "hard times" the erection of silk mills scarcely stopped, until now they employ nearly twice as many hands as they did six years ago. Besides, the system of manufacturing in the homes of the workingmen has attained wonderful proportions within a few years. When the hard times came, and weaving fell off, many of the weavers began to manufacture in a very small way for themselves; as they succeeded, others tried it, and to-day there are not less than 500 looms owned by practical weavers, and operated under their immediate supervision in rooms, garrets, sheds, and every place where a loom can be worked. Whole families thus find employment in their own homes; the men do the most difficult part, the women and children assist, and all feel that they are working for themselves. The profits of the trade are said to be small, for the largest as well as the smallest manufacturers, but the business is unmistakably prosperous, and many of the great mills have worked overtime for many months.

Notwithstanding the development of vast mills and other huge manufacturing establishments, incident to the use of steam and the accumulation of capital, the opportunities for independent production by individual workers are more numerous and more profitable to-day than ever before—for workers with small capital, we mean. No able worker who really wishes to be his own master, and is willing to work, need lack for chances. The man who will let himself become the "slave of capital" is usually incompetent of self direction and real independence.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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For Sale.—9 pieces 2 7-16 turned shaft, 11 feet long; coupled; good as new. Frisbie & Co., New Haven, Ct.

American Fruit Drier Mfg. Co., Chambersburg, Pa.

Cheap.—Nearly New Vertical Tubular Boiler, 30 x 60 inches. Box 121, Salisbury, Md.

Downer's Anti-Incrustation Liquid.—J. W. Hamburger, Wholesale Furniture Manufacturer, Hester and Elizabeth Sts., New York, says: "Your Boiler Liquid is a success. I am using hard well water, but your Liquid prevents the formation of scale, and my tubes are clean. I shall continue to use it, and heartily recommend it to others." A. H. Downer, 17 Peck Slip, New York.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Factory Fire Hose.—A large lot for sale cheap. W. F. Corne, Agent, 117 High St., Boston, Mass.

For Sale.—Canadian Patent for Automatic Mash Machine, successfully introduced in the U.S. A most valuable invention, capable of being successfully introduced in every brewery. A rare chance for a live man. Michael J. Stark, Buffalo, N. Y.

Wanted—A good Metal Pattern Maker of considerable experience. Sargent & Co., New Haven, Conn.

For Sationary or Portable Engines, Circular Saw Mills, Grist Mills, and Mill Machinery, good and cheap, address the old manufacturers of Cooper Mfg. Co., Mt. Vernon, O.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

"Workshop Receipts" for Manufacturers, Mechanics, and Scientific Amateurs. Illustrated. $2, mail free. E. & F. N. Spon, 446 Broome St., New York.

For Screw Cutting Engine Lathes of 14, 15, 18, and 22 in. Swing. Address Star Tool Co., Providence, R. I.

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New Pamphlet of "Burnham's Standard Turbine Wheel" sent free by N. F. Burnham, York, Pa.

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Eagle Anvils, 9 cents per pound. Fully warranted.

Vertical Burr Mill. C. K. Bullock, Phila., Pa.

Eclipse Portable Engine. See illustrated adv., p. 382.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Acme Lathes.—Swing, 7 in.; turn, 19 in. long; back geared; screw cutting. Send 3 cent stamp for circular and price, to W. Donaldson, southwest corner Smith and Augusta, Cincinnati, Ohio.

Forsaith & Co., Manchester, N. H., and 213 Centre St., New York. Specialties.—Bolt Forging Machines, Power Hammers, Combined Hand Fire Engines and Hose Carriages, new and 2d hand machinery. Send stamp for illustrated catalogues, stating just what you want.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Needle Pointed Iron, Brass, and Steel Wire for all purposes. W. Crabb, Newark, N. J.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are being sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d & Wood St., Phila., Pa.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

The best Friction Clutch Pulley and Friction Hoisting Machinery in the world, to be seen with power applied, 95 and 97 Liberty St., New York. D. Frisbie & Co., New Haven, Conn.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Wood-working Machinery, Waymouth Lathes. Specialty, Wardwell Patent Saw Bench; it has no equal. Improved Patent Planers; Elevators; Dowel Machines. Rollstone Machine Company, Fitchburg, Mass.

The Twiss Automatic Engine; Also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Dead Pulleys that stop the running of loose pulleys and their belts, controlled from any point. Send for catalogue. Taper Sleeve Pulley Works, Erie, Pa.

No gum! No grit! No acid! Anti-Corrosive Cylinder Oil is the best in the world, and the first and only oil that perfectly lubricates a railroad locomotive cylinder, doing it with half the quantity required of best lard or tallow, giving increased power and less wear to machinery, with entire freedom from gum, stain, or corrosion of any sort, and it is equally superior for all steam cylinders or heavy work where body or cooling qualities are indispensable. A fair trial insures its continued use. Address E. H. Kellogg, sole manufacturer, 17 Cedar St., New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

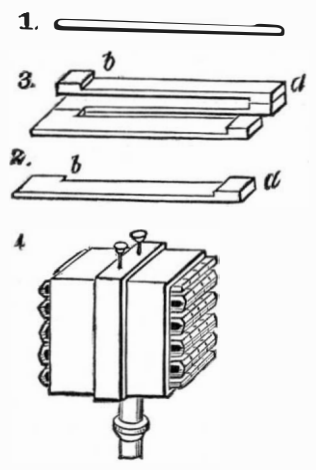
(1) C. L. writes: 1. In making induction coil (SUPPLEMENT No. 160) would it be of any advantage to wrap insulated wire (secondary) in two sections instead of across? A. Yes, the insulation need not be so perfect. You should use the same weight of wire as recommended in the SUPPLEMENT referred to. 2. Of what dimensions should it be to work electric pen (SUPPLEMENT No. 166), and would not a gravity battery answer better than a Grenet? A. A coil that will give a ⅛ (one eighth) inch spark will do. For continued use a battery composed of several gravity cells would answer very well. 3. I want to work a telegraph one hundred yards; shall I use ground connections or double wires? A. Use a return wire.

(2) J. K. asks: Which end of a horizontal cylinder receives the most steam? A. The piston rod end receives the least steam, and less work is done during that stroke.

(3) C. E. W. W. writes: I have not yet been able to find a cement entirely suitable for cementing rubber to wood: can you suggest something? A. 1. A good glue answers very well in some cases; the parts to be joined must, of course, be held well together while the glue is drying. 2. Melt together over a gentle fire equal parts of black pitch and gutta percha. If this is required to set very hard, one part of powdered shellac may be added. The addition of say a tenth part of caoutchouc clippings makes it more adhesive, but prevents in a measure its final hardening. This cement should be used hot.

(4) F. N. R.—The arrangement of copper lightning rods on the building, as you propose, will do very well, provided the bottoms of the rods are made to extend underground for a considerable distance, so that there will be a large conducting surface in contact with the earth. The common fault in lightning rods is that they are not sufficiently connected with the ground. They are generally stuck down two or three feet into dry earth; but such an arrangement is worse than useless; it is almost like placing the bottoms of the rods in a glass bottle. In all cases the bottoms of the rods underground should be connected with iron or water pipes, if they exist; or in lieu thereof, the rods should be extended a long distance underground, or should connect with a mass of old iron, or iron ore, or charcoal, or coal dust of any kind, laid in a trench. No lightning rod can be regarded as a safe conductor unless its lower extremity is carried deep into the ground, and there put in good connection with a large surface of conducting material.

(5) K. L. writes: With regard to Melloni's thermo-electric pile, one can read in books of physics sentences as the following one: "The thermo-multiplier consists of a series of small bars of antimony and bismuth, *a* and *b*, soldered together at their alternate ends." Well, this is all very nice, but the moment you come to put together those pieces of metal, all sorts of difficulties arise at once. 1st. You cannot get the bismuth to flow when melted; it is always in a kind of lump. 2d. The small piece of antimony is so brittle, that the moment you try to work it, immediately it falls into pieces. 3d. It seems impossible to solder them together. What is then to be done? A. The elements of the thermopile are made of antimony-glance and bismuth, cast in iron moulds and shaped with a file, as shown, full



size, in Fig 1. The bars of antimony must be tinned on both heads, *a b*, with very fusible solder by means of a small soldering iron. The bars of antimony and bismuth may be held together between spring forceps, and the spaces between the bars filled with pieces of wood, which may be allowed to remain to impart greater solidity to the pile, but they must not extend beyond the joints. The vertical rows of five pairs each are first soldered, and these are united when all of the pairs are complete. The end pieces of each row must have an offset at right angles to the bar, as shown in Fig. 2. Fig. 3 shows the combination of the end pieces of two vertical rows. When the pack of 20 or 25 pairs is completed, lay it in a round or square case of brass, having first soldered to the middle of the first and last bars short copper wires, which pass through two ivory lined holes in the case and are provided with permanent binding screws. The vacant spaces are then filled with plaster of Paris, which is afterward scraped away so as to leave the ends of the bars bare, and these are then blackened. In making this instrument a great deal of patience is required, as a breaking of a number of the bars is unavoidable.

(6) D. writes: Take a dozen or more sheets of blotting pad, size of your letter book. Dip every other one in water and put under press, wet and dry alternately, for a few minutes. Keep in tin box with lid, and use instead of wetting with brush. No need of oiled paper even after a little practice. Twenty or more letters can be copied at once as well as one, placing pad, tissue paper, letter, pad, tissue, at pleasure. One wetting will last several days.

(7) D. D. asks if black and white are colors in a scientific view. A. Black is the absence of color; white is the union of all colors.

(8) H. S H. writes: In your issue for March 8th, you tell D. J. C. (34), that you "do not think sunlight ever put out fire;" that "the difference in the heat of a fire with and without sunlight must be infinitesimal, if anything." I have repeatedly seen the brightest fire grow dull and cease burning when the full sunlight fell directly on the draught. The effect of the sunlight was the same as if some one had put water in the fire. In a west room at my father's house there was a stove so situated that the rays from the afternoon sun fell directly on the hearth, and unless the curtain was lowered the fire would almost cease to burn. This is the experience of many a housewife, and I with many others have often wished to know just why this was so. A. It is possible that the sun heat may in some slight degree affect the draught, but we are still of the opinion that the superior brightness of the sunlight renders the fire very dull by comparison, in much the same way as an electric light in proximity to a gas flame makes the latter appear of a deep orange color, whereas, before comparison with the electric light it would have been considered fairly white.

(9) H. J. B. asks: 1. What size balloon does it require to hold 10,000 cubic feet of ordinary street gas? A. The inflated bag should have a diameter of nearly 27 feet. 2. What weight is it capable of raising? A. About 340 lb., less the weight of the bag. 3. What would be about the cost of a balloon that size? A. Properly equipped, about $500.

(10) W. H. S. asks: 1. What part of a horse power would a small stationary engine, 3 inch stroke, cylinder 1½ inch bore, with a balance wheel 12 inches in diameter, be? A. See rule for calculating the horse power of engines on p. 267 current volume, query (4). 2. How large a boiler would it require to run the engine: the diameter and length? A. This will depend upon the pressure of steam you wish to carry and the number of revolutions per minute. 3. Could it be arranged to heat by kerosene or alcohol? A. Yes. 4. Which would be the best? A. Alcohol. 5. Please tell me how to arrange it to get the most heat with the least fuel. A. Arrange the lamp like any alcohol lamp, but with a sufficient number of wicks; it would be safer to have the vessel for alcohol at a distance from the lamp, like a German student's lamp.

(11) C. S. C. asks for the best method for making a soldering fluid for mending tinware without an iron. A. Dissolve zinc in muriatic acid until bubbling ceases, and add a quantity of water equivalent to that of the acid.

(12) "Investigator," writing of his father's experiment in treating wood some 40 years since, says: He buried in bituminous coal dust different descriptions of wood, and passed a current of hot steam through the pile; by this means he accomplished his intention even beyond his expectations. The wood became thoroughly imbued with the acid from the coal and shrank up to smaller proportions; the pores of the wood closed and became densely compact. The softer the fiber of the wood the more thorough the result, seemingly.

(13) S., B. & Co. ask if it will be possible to speak through a tube 400 to 500 feet long, running through the air (or on the outside of a wall), and of what material it would be best to make the tube of, iron or tin. A. Yes. Make the tube of tin, and have well rounded elbows.

(14) S. P. T. asks: Where would a person have to begin to study to be an engineer in the navy? A. At the Naval Academy at Annapolis, Md.

(15) B. writes: In your paper of the 12th of April, J. L. C., among other questions, asks: Will more water run through a one inch perpendicular pipe, 10 feet long, than through a one inch pipe, one foot long? Your answer is, Yes if they are even at the top and both taken from the same tank. Now why is more water forced into the long pipe, when the head or pressure is the same upon the opening of each? Please explain. A. There is a greater head on the 10 foot pipe than the one foot. The head is the height above the point of delivery, and not above the point of entrance to the pipes.

(16) G. McD. asks: In a B flat cornet which has the most friction, a piston or a rotary valve? A. Practically a piston valve.

(17) E. D. W. asks if there is any more danger from lightning on a telegraph line, in using bare copper wire for a ground from the lightning arrester, than in using insulated wire. A. No.

(18) R. T. C. writes: I wish to cut a piece of Iceland spar to a particular shape and polish it. Please inform me how I can polish the Iceland spar when I cut, so a ray of light will pass through it. I want it very smooth, as much so as a looking glass. A. You may cut it with a thin iron rotating disk supplied with emery and water, and you may polish it with a lap of copper charged with emery and water or emery and oil. Use different grades of emery, gradually increasing in fineness, and finally polish with a paste of putty powder, using a pewter lap.

(19) R. M. M. asks: 1. What books or papers must I procure in order to get a thorough knowledge of making ice by artificial means? A. Consult SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 85 and 91, and pp. 95 and 335, volume 37, and 159 and 387, volume 38, SCIENTIFIC AMERICAN. 2. Also, is there any process by which raw hide may be rendered impervious to water? A. We believe there are several patented processes which claim to accomplish this. Paraffine under pressure and in solution is claimed to satisfy the requirements.

(20) P. G.—For directions for removing superfluous hair, see volume 39, p. 75 (26), p. 91 (1) SCIENTIFIC AMERICAN.

(21) J. B. H. writes: I see in a recent number of the SCIENTIFIC AMERICAN, that J. P. J. asks you about building a scow to be run by a steam wheel. I have just finished the machinery for a scow 65 feet long, 16 feet beam, 3 feet draught of water. We put in a propeller wheel, 46 inches diameter, with a power of cylinder 8x12, with an upright boiler, 38 inches diameter by 78 inches high. She will carry about 28 cords of hickory wood, and make 6 to 7 miles per hour with 60 lb. steam. My experience is that the propeller wheel works better and with much less power than the old time steam wheels that we used to use down on the Ohio and Mississippi rivers.

(22) J. C. asks: What will remove the glossiness on cloth that appears on the knees and elbows of clothing after having been worn some time? A. There is no permanent remedy, since it is due to the wearing away of the "nap." A weak solution of ammonia will remove the gloss temporarily.

(23) W. K. asks: Can you inform me how to make cider in vinegar in a quick, wholesome way, or refer me to some number of your paper that has the process in? I have plenty of cider 6 years old that is very slow to make into sharp vinegar. A. Consult a General Treatise on the Manufacture of Vinegar, by Professor H. Dussauce (including all known quick processes). A full description of this process would occupy too much space in these columns.

(24) W. F. H. asks how to turn and fit a butterfly valve which has a solid stem running through the boss on valve. How to tell whether both ends of valve will fit before the sides are small enough. A. Cast on the valve a spindle which will coincide with the axis of the pipe to which the valve is fitted. Turn the valve to fit its seat, then saw off the cast spindle and fit in the spindle which is to support and move the valve, then fit the valve by filing or by turning off a very little from its sides near the spindle.

(25) I. C. McL. asks if there is any chemical that could be put into white iron to toughen it, that is, to put in the mixture when the iron is melted: if so what is it? We use this iron in the manufacture of bells. A. The toughness and hardness of iron and steel are increased by the addition of certain amounts of tungsten.

(26) C. E. L. writes: I frequently notice in your paper inquiries about ground connections on telegraph lines, and I think the subject is one that deserves more attention than is commonly given to it, as poor grounds are causes of more trouble to the amateur and inexperienced telegrapher than anything else. Current school text books describe a ground connection as a sheet of copper ten or twelve feet square buried at each end of the line. The expense of such a ground would in many cases be greater than the whole cost of wire and instruments, and of course it could not be thought of for an amateur line, where, as a general thing, expense is the first consideration. The best ground is a connec-

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tion with a gas or water pipe; if possible it should be at a brass section of the pipe rather than an iron or lead, and it should be soldered when possible. The surface should be thoroughly brightened and the wire given ten or twenty turns around the pipe. In cases where a gas or water connection cannot be reached, a very good ground can in many cases be made by driving a rod of iron five or six feet into the ground; this will generally work well if the wire is soldered to it. A sheet of zinc or galvanized iron of say 10 square feet surface will answer every purpose if the soil is not too dry. It should be set in a vertical position. I have a galvanized sheet iron ground which has worked well for six years. In sections of country where the soil is shallow a greater surface will be necessary to make up for the lack of depth. I have made good grounds by soldering a number of old oyster cans to a wire, and by burying iron turnings and filings in a trench. A failure of any of these methods should not discourage, as it often happens that a change of a few feet in the location will find success.

(27) G. W. L. asks how to enamel paper tubes and packages to contain butter, lard, etc., and similar substances. A. A sirupy alcoholic solution of bleached shellac mixed with terra alba or other opaque harmless earth has been employed for similar purposes.

(28) H. M. J. asks how phosphor bronze is made. A. See p. 411 (30), vol. 39, SCIENTIFIC AMERICAN.

(29) R. & T. write in answer to W. M. M., query No. 23, page 203, current volume of SCIENTIFIC AMERICAN: It is necessary for a practical man to have the mill stone before him and to know what quality and quantity of work is required of the same, also to see the grain to be ground; because of the many different circumstances controlling the millstone, it is impossible to lay down any fixed rule for a stone, as we are governed solely by conditions, and as such, milling is not a science but an art, and must, therefore, be handled to suit circumstances and conditions.

(30) D. J. W. asks for a receipt for making a blue writing ink that can be made in small quantities, say ½ gallon, of these qualities: color bright blue, will not settle or thicken on exposure to the air, and flows freely. A. Coupier's blue, also known by the name of indulin, dissolved in water in the ratio of 20 parts to 1,000 of water, forms a writing ink of a good color, which it retains when treated with chemical agents. It does not corrode steel pens. Anything added to ink to prevent evaporation also tends to prevent it drying when written with. Replace the water lost by evaporation occasionally.

(31) W. H. H. asks: 1. Will ordinary coal lose a part of its weight by being exposed to the air and sun? A. Yes, if it contains much moisture and sulphides. 2. If it does, what per cent of its weight will it lose? A. It depends upon the amount of moisture, sulphides, etc., present in the coal, and the conditions, time, etc., of exposure.

(32) H. L. writes: I have a good deal of trouble with my lard, which I work every day in the hot weather; it gets sour very often. Can you suggest anything that will keep lard sweet? A. In hot climates a small quantity of calcium sulphite is sometimes used, a few grains to the ounce.

(33) D. W. C. writes: In your issue of March 29, page 203, W. M. M. asked: "In laying off a millstone in furrows, what draught is given; what amount of the space of a stone is given to furrows and what to grinding surface?" The draught of the furrows of millstones should be in proportion to their diameters, that is, to give stones of different diameters equal draughts, the distance of their furrows from the center must be in direct proportions to their diameters. A stone four feet in diameter, the draught of the leading furrows should be two inches from the center of the stone, and all other small furrrows should be parallel to the leading furrows; the whole surface of the face of the stone should be given to furrows, to form edges; because the principle of grinding is that of shears clipping; the furrows serving as edges to cut the grain; therefore, it is plain that the more cutting edges the stone has, the faster it will grind. The best dress that I have put on a stone is laid off in this form: divide the face of the stone into sixteen leading furrows; then divide the sections of the stone into as many straw furrows as possible. These straw furrows should be very narrow, and be made parallel with the leading furrows.

(34) C. M. D. writes: Please inform G. M. A., in "Answers to Correspondents," that he can get a very good and durable coat of brown on his gun, by allowing it to get covered with salt spray and letting it rust for a day or two, after which he must rub off the loose rust and give the barrel a couple of coats of oil.

(35) S. B. G. asks: 1. Should a violin be left in tune when laid away? A. Yes. 2. At what angle to the axis of the wheel should the wings of a wind power be set? A. The mean angle should be from 15° to 17° from the plane of rotation of the wheel. 3. If a small log be split into halves or quarters it will spring outward, and appears as though the heart side is longer than the bark side. What is the cause of it: does the wood of the bark side contract, or does the wood of the heart side lengthen? A. The moister sap wood probably contracts most on exposure to the air.

(36) J. H. asks: 1. What kind of wax or varnish is used in etching on steel with nitric acid? A. Beeswax or paraffin. 2. What parts of a locomotive are called the journals? A. The cylindrical parts of the axles, which revolve in the boxes. 3. A friend of mine has been disputing with me about governors: he says that they are all self-regulating, while I claim that the engineer has to judge from the speed of the balls. A. All governors are intended to be automatic or self-regulating.

(37) W. S. W. asks: 1. Can a young man get enough knowledge of locomotive engineering by hard study, to materially lessen the time required on an engine as fireman? If so, what time would it require and what books would you recommend? A. Yes. "Bourne's Hand Book of the Steam Engine," and "Forney on Locomotives," and "Reynolds' Locomotive Engine Driving." 2. How long should a young man, who has a taste for the business, fire a locomotive before being qualified for promotion to engineer? A. It depends upon his intelligence, application, and observation. 3. What traits of character are required in order to become a good locomotive engineer? A. System; habits of close observation; readiness of resource; a cool head, and great presence of mind. 4. Is there any difference in the power of two locomotives of equal weight, one having 4 and the other 6 drivers, the drivers to be of the same diameter? A. No, if friction is not considered. 5. What is about the average weight of American locomotives? A. 36 to 35 tons.

(38) C. B. asks: 1. Have any vessels been constructed to go under water? A. Yes; Fulton constructed one, and in the early years of the late war there were at least two successfully operated in New York harbor. 2. Have any electrical engines of one horse power or more been invented? A. Yes, there have been many made of small power. You will find descriptions of both of them in the back numbers of the SCIENTIFIC AMERICAN.

(39) B. F. asks: Does it take any more power to force a column of water through 1,000 feet of pipe on an inclined plane and raise it 70 feet than it does to force a column through 70 feet perpendicularly? A. Yes, by the amount of friction of the increased length of pipe required.

(40) J. D. asks: What size wire cable was in use at the hauling off the steamship Americus into deep water at the time she was stranded on Long Branch Beach, and also what power engines were in use on her to get her off? A. No wire rope used, but four 18 inch hemp cables, with blocks and falls from the cables to the drum of the ship's hoisting engines.

(43) M. O. D. asks: 1. Do you know of any materials that are preferable to infusorial earth and wrought iron turnings for use in a vessel for filtering drinking water? Will it answer to mix them together in one mass? A. Well burned granular charcoal is in many cases preferable to iron in such a filter. You will find an excellent article on the purification of drinking water on p. 414 et seq., Science Record for 1874. See also p. 346, vol. 39, SCIENTIFIC AMERICAN. For the purification of water containing much organic matter, Dr. Crookes recommends the addition in the proportion of from one to two parts of the following mixture to every 1,000 parts of the water: Permanganate of lime, 1 part; sulphate of alumina, 10 parts; fine pipe clay, 30 parts; intimately mix. After settling for 15 minutes the water can be drawn off from the sediment without filtering. 2. Is there any objection to a brass vessel tinned inside? A. Yes, wood is preferable. 3. Are tinned iron wire screens objectionable; how fine should the mesh be? A. Stout cotton cloth will be found more serviceable, and is less objectionable. 4. Will the same filtering materials answer for boiler feed water? If thoroughly cleaned once a day how long a time will the filtering materials last? A. It would depend much upon the water.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L. S. S.—21. A green trap rock, contains pyrite, quartz, and garnet. 22. Similar to No. 21 with serpentine. This sample contains traces of gold.—J. C.—Apatite, calcium phosphate, containing more or less calcium chloride and fluoride.—E. H. A.—Fossiliferous limestone.—C. I.—Arsenical pyrites in talcose slate. It contains traces of gold.—J. R.—No. 1. Chiefly hornblende and calcite containing graphite (plumbago). No. 2. To get the value of mineral specimens you should address some dealer in minerals.—E. E. C.—The bead is composed chiefly of lead. It contains a trace of silver.

COMMUNICATIONS RECEIVED.

On the Whirlpool. By T. P. R.
On Consumption. By R. R. G.
On the Autopsy of an Elephant. By A. J. H.
On the Destruction of Insects. By F. L. J.
Removing Stains. By J. C. W.

[OFFICIAL.]

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May 13, 1879,

AND EACH BEARING THAT DATE.

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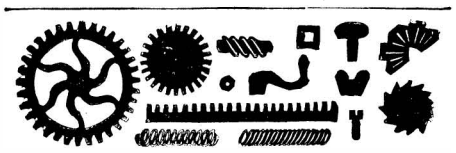

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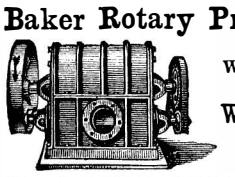

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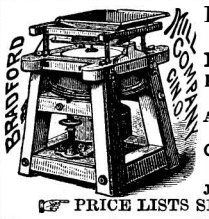

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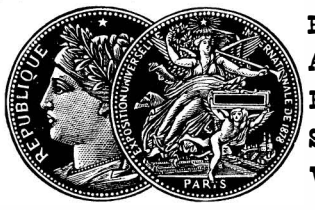

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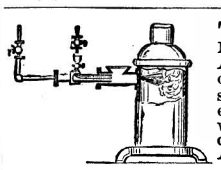

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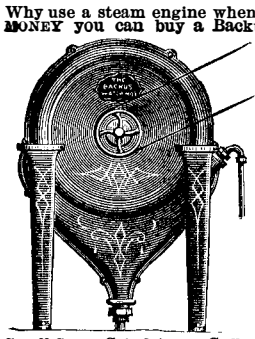

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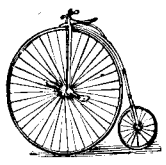

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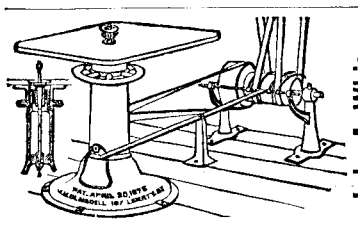

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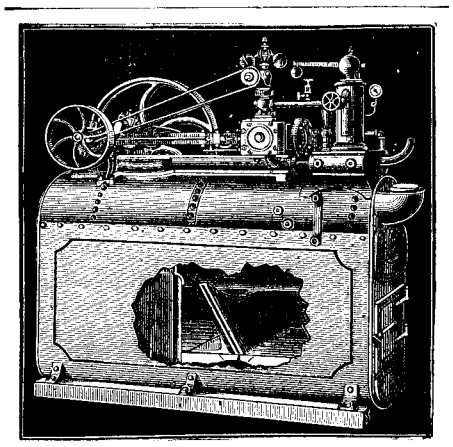

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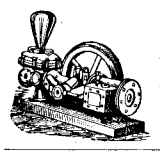

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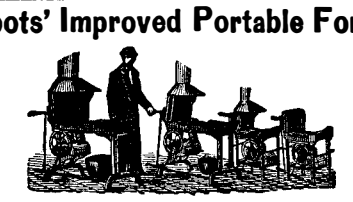

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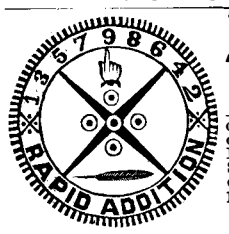

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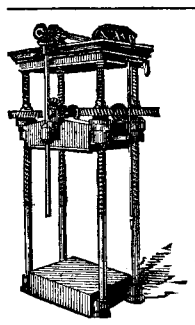

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